A/02

CITY of BEAVERCREEK

June 30, 1986

TO: COUNCIL AND PLANNING COMMISSION

FROM: CLEAN WATER TASK FORCE

SUBJECT: GROUND WATER QUALITY REPORT

The attached constitutes the final report of the Beavercreek Clean Water Task Force. The Task Force feels very strongly that the recommendations contained in the report should be implemented as quickly as possible. These recommendations represent what we feel are the absolute minimum actions required to remedy current contamination problems and assist in preventing further problems.

While we are aware this document is not all inclusive, it does provide a sound base from which to expand. The City should carefully study this document and aggressively work toward implementing these recommendations.

Sincerely,

J. Mike Livingston
Chairman, Clean Water Task Force

BEAVERCREEK CITY HALL
1368 Research Park Drive • Beavercreek, Ohio 45432 • (513) 426-5170

GROUNDWATER QUALITY IN BEAVERCREEK, OHIO, 1986

Prepared By:

The Clean Water Task Force *

Submitted To:

Beavercreek City Council
Beavercreek Township Trustees
Beavercreek Planning Commission

June, 1986

* Ike Beediwala
Dorothy Hooker
J. "Mike" Livingston, Chairman
Julie Neeley
Jerry Petrak
Dennis Phillips
Nikki Taylor

TABLE OF CONTENTS

I. INTRODUCTION

The Beavercreek Clean Water Task Force was initiated by the City of Beavercreek Planning Commission in September 1985 after a significant amount of public concern had been exhibited over the discovery of volatile organic compounds (VOC) in well water along Dayton-Xenia Road. A call for volunteers was made through the Beavercreek News in an effort to get both technical and non-technical representation on the Task Force. A total of six people from the city served on the Task Force. They are; Nikki Taylor, a homemaker; Julie Neeley, a medical laboratory technologist; Dorothy Hooker, a Wright State University Environmental Science student; Ike Beediwala, an engineer with an environmental background; Jerry Petrak, a materials engineer; and Mike Livingston, an environmental scientist. After the Task Force had been functioning, it became evident that the township was also involved in the problem. Consequently, they were invited to designate a member to the Task Force. Dennis Phillips, a local businessman, was designated as the Township representative.

The initial charge given by the Planning Commission to the Task Force was to look into the water problems in Beavercreek, assess the general quality of water, and make some recommendations concerning the preservation of water quality. The Task Force accepted the charge and in its first meeting decided to expand on it and developed the following charter:

Charter

The Beavercreek Clean Water Task Force (BCWTF) is formed under the direction of the City of Beavercreek Planning Commission with the approval of the City Council and membership is made up of individuals appointed by the Commission. The purpose of the BCWTF is to investigate the quality of drinking water in the City of Beavercreek. Specifically, the BCWTF is to determine if a contamination problem exists in Beavercreek drinking water and if so, what steps can be taken to clean up the water. If a contamination problem does not currently exist, what steps can be taken to insure safe drinking water in the future for residents of Beavercreek. The end product of the BCWTF will be a set of recommendations to the Commission and may consist of draft ordinances, draft planning guidelines, draft health regulations, and other similar items.

The BCWTF, although appointed by the Planning Commission, is an independent entity and is not subject to the control of the Commission. The BCWTF may have communication with any agency or person it deems necessary in investigating this problem. The BCWTF is not authorized to obligate the City of Beavercreek any fiscal expenditures.

The original BCWTF schedule called for a three phased approach (Phase I, Fact Finding; Phase II, Data Analysis; Phase III, Report Preparation) to gain insight into the problem and develop recommendations. It was expected that the Task Force could complete its study and have recommendations before the end of winter. Events dictated major deviations from this original schedule.

During the fact finding phase the Task Force interviewed various government agency representatives, both service and regulatory, and technical experts from Wright State University to determine what was known about the alleged pollution of the ground water, hydrogeologic characteristics of the area and potential sources for pollution in the future. This was envisioned to be the most extensive facet of the Task Force's work. Details of this phase make up the major portion of the remainder of this report.

Shortly after the Task Force was organized, a major discovery of VOC in well water was made at several sites along E. Patterson Road. This discovery was of widespread concern in the community and constituted an emergency. As such, the Task Force deviated from its original intent and expended considerable time in assisting and evaluating various issues involving the E. Patterson Rd., Alpha, and Shadybrook Plat contamination episodes.

This report is a compilation of facts, data, and observations of both already existing data and data generated by the Task Force. It does not purport to be all inclusive nor does it involve the weighty technical issues of safety and health hazards and risks. These two issues are better left to technical experts to explain in greater depth. This report fulfills the Task Force's objective of providing recommendations for both short and long term approaches to be taken by the city for improvement and protection of its water resources.

II. UNDERGROUND WATER IN BEAVERCREEK

A. GROUND WATER

Almost all of the underground water in the city and township of Beavercreek is connected to a single aquifer. This aquifer underlies the entire Beavercreek Township.

The aquifer is largely isolated from other surrounding underground water supplies except to the north. To the west, the underground buried hills and valleys are such that there is virtually no connection to the aquifer underlying Montgomery County. The deepest part of the aquifer forms a "tee" (or a cross) with the north-south leg of the tee running along Beaver Valley following the Beaver Creek and continuing generally south along the Little Miami River. The east-west part of the tee from the west follows the Little Beaver Creek to about its junction with the Little Miami River. The east leg of the tee follows the Little Miami River and flow is toward the west. All of the areas adjacent to this deep part of the aquifer act to replenish or recharge the underground water.

The recharge area extends away from the deep aquifer until it meets the highest point of the underground rock formation. For Beavercreek, this means there are very few areas that do not directly feed the one aquifer. Most of the township is in the catchment or recharge area of this single underground water supply.

Flow of the water in an aquifer is very slow, being from a few inches to a few feet per day, depending on the medium through which it is flowing. Most of the aquifer in Beavercreek is comprised of sand and gravel in which the water flows at a rate of approximately a foot a day, or 300 to 400 feet a year. This is an average flow rate and in different areas the flow may be faster or slower.

The general directions of flow are fairly well established for parts of the aquifer. It is generally accepted that in the north-south part of the tee, the flow is from the north to the south. It is believed by some that the flow in the east-west leg is from the west along the Little Beaver Creek toward the Little Miami River. From the east, the flow is generally toward the west until it reaches the junction with the Little Beaver Creek. At some locations and at some depths within the aquifer, the direction may change but in general the flow is as described. For instance, flow directions can change due to pumping rates from large wells.

B. DOMESTIC WATER

Water used by the residents of the city/township comes from two sources. The two sources are the previously described aquifer and the City of Dayton's well fields. The water from Dayton supplies several plats along the Greene-Montgomery County line.

Within Beavercreek City there are 12,000 to 13,000 residential dwellings. Of these approximately 5,000 to 6,000 are connected to a public water supply. In Beavercreek, all public water is provided by Greene County. (The Dayton water is bought and resold by Greene County). Those homes not connected to public water are generally on private wells. (There are a few small private multi-user well systems). In other words, less than half the residents are connected to a public system and significantly more than half are on private wells.

Of the two sources of public water, by far the greatest amount comes from two well fields on the single source aquifer. One well field is north of Rotary Park and the other is at the east end of Shakertown Road. Both fields are in the general area of the intersection of the deep north-south and the deep east-west aquifer.

III. RESPONSIBILITY FOR WATER QUALITY

While no one would disagree that clean, safe drinking water should be a matter of top priority, no one agency can be thought of as a protector of water resources. Listed below are those agencies and regulations intended to protect public water:

U.S. EPA - U.S. EPA is responsible for environmental protection, has regulatory and enforcement authority, and administers the Clean Water Act, Clean Air Act, RCRA (Resource Conservation and Recovery Act), CERCLA (Super Fund), and TSCA (Toxic Substance Control Act). It regulates surface water, underground water, underground storage, and public water discharge.

Ohio EPA - Responsible for environmental issues similar to those addressed by the U.S. EPA but at the state level.

NFPA - National Fire Protection Association. International voluntary membership organization to improve fire protection. National fire codes are the recommended practices for local fire department.

NIOSH - National Institute of Occupational Safety and Health tests and certifies air exposure limits and assists OSHA (Occupational Safety and Health Administration) and Mine Safety and Health Administration.

NPDES - National Pollutant Discharge Elimination System is a program established under the Water Pollution Control Act which requires an EPA permit to discharge waste into surface water.

Safe Drinking Water Act - Implementing regulations establishing maximum contamination levels. See Appendix 1.

Superfund - The federal money provided to implement the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) which authorizes emergency action to clean up both abandoned and existing waste disposal sites which pose substantial danger to the public.

DOT - Department of Transportation regulates transportation of chemicals and hazardous materials.

RCRA - Resource Conservation and Recovery Act gives the EPA the authority to regulate hazardous waste from cradle to grave.

OSHA - Occupational Safety and Health Administration of the Department of Labor regulates safety and health for industry and business.

Greene County Sanitary Engineering Department - Provides public water and monitors water quality in those systems. Responsible for treatment of water discharged from domestic and commercial sectors.

Greene County Health District - Monitors the quality of drinking water for private sources. Issues health warnings as appropriate.

Miami Valley Regional Planning Commission - Provides planning and guidance in large scale ground water protection studies and strategy implementation. It also serves as a resource center for various ground water related activities.

City of Beavercreek - With the assistance of all federal, state, and local resources, insures that basic water quality standards are met. It is vested with the responsibility of protecting the health and welfare of its citizens.

IV. INITIAL FACT FINDING

In an effort to better understand Beavercreek's groundwater situation, information was gathered from various sources, including local experts.

On October 31, 1985, Wright State Professor of Geological Sciences, Dr. Ben Richard, spoke to BCWTF. The information presented detailed the nature of aquifers in general, and more specifically, described the aquifer from which Beavercreek derives its drinking water.

According to Dr. Richard, aquifers are composed of permeable or porous geological materials, either unconsolidated sand and gravel or consolidated material such as rock and clay. There are two types of aquifers--confined and unconfined. The unconfined aquifer is not overlaid by impermeable material and may be fairly close to the surface. Recharge is by water seeping through the soil. Therefore, unconfined aquifers can be quite susceptible to contamination and volume fluctuates according to seasonal cycles of precipitation and man's use of the water. Confined aquifers generally are at a greater depth and are bounded on top and bottom by layers of relatively impermeable material called aquitards.

The geological make-up of an area dictates the quantity and quality of groundwater present. The major subsurface feature in the Beavercreek area is the Hamilton River Valley. The material in this river valley consists chiefly of sand and gravel overlaid with a mixture of clay, silt, sand, gravel, and boulders. Sites along and at the intersections of various bodies of water (i.e., the Beaver Creek, Little Beaver Creek, and the Little Miami River), provide the best ground water supply. In other areas of Beavercreek, the bedrock formation is higher, thus limiting the quantity of water available.

Beavercreek is supplied with water from a combination of private wells and public water systems. Approximately 60% of Beavercreek's water supply is derived from private wells, with the remaining 40% flowing from public well fields. Public water in Beavercreek has two sources:

1) The underlying aquifer which supplies the North Beavercreek well field near Dayton-Xenia Road and Beaver Valley Road and the South Beavercreek well field at Shakertown Road near Shaker Estates.

2) Water from the Dayton system.

The North Beavercreek well field is situated on land which was donated to the county for this purpose, therefore the well field was developed here because it was economical, not necessarily because it was the best source of water. These wells are about 100 feet deep and have twelve inch diameter casings according to Tim Denger, Greene County Sanitary Engineer. The actual wells are not at the point of the lowest bedrock in the area and thus are not geologically best for producing optimum quantity. Professor Richard recommended that large volume water users not drill wells within one mile of the county wells because the "draw down" effect toward the large private well would further reduce the quantity available in the public well field.

Professor Richard also expressed concern about the protection of the quality of Beavercreek's groundwater supply. He pointed out that, geologically, Dayton and Montgomery County are below the Beavercreek bedrock formation. Since ground water will not flow uphill, Beavercreek is thus protected by a natural contamination barrier from these two sources.

A point source that could pose a problem for Beavercreek is the Fairborn City Landfill which is located over the aquifer flowing towards the North Beavercreek well field. Professor Richard pointed out that any landfill is a potential source of contamination, especially from heavy metals. He suggested the establishment of monitor wells surrounding this well field that could be pumped and evaluated for contamination. Professor Richard stressed that the first line of defense is prevention.

On November 6, 1985 and on November 25, 1985, the Greene County Sanitary Engineer, Timothy Denger, was a speaker at the BCWTF meetings. The Sanitary engineer regulates both the public water supplies and sewage treatment facilities. Mr. Denger indicated that the annual operating budget of approximately $4 million is derived from the users of the facilities. The Sanitary Engineering Department has jurisdiction over public water supplies that have more than 15 service connections or those which provide water to more than 25 persons for 65 days per year.

The treatment of the public water supply was described. Iron and manganese are removed through an oxidation process, and the water is then filtered and chlorinated. The fluoride level is adjusted to an optimum of 0.8 - 1.3 parts per billion (ppb).

Mr. Denger defined the terms "primary contaminant" as one which is health effect related, and a "secondary contaminant" as one which is of aesthetic concern only i.e., iron and sulfur.

Beavercreek's public water is tested for chemical contaminants according to the minimum test intervals specified by the Ohio Environmental Protection Agency (OEPA). The public water system is sampled daily for chlorine and fluoride, once a week for iron, and nine times a month for coliform bacteria. The schedule also involves testing for inorganic contaminants every 3 years, and radioactive contaminants are checked once every four years. Testing for pesticides is no longer required and therefore is not done. No OEPA regulations exist which require testing public water supplies for volatile organic compounds (VOC). However, following the Shadybrook incident, Greene County began testing the public water for VOC's and total trihalomethanes on a biannual basis. The initial VOC test was performed in July of 1985 with a follow-up test in January 1986. No VOC's were detected in either of the samples although chloroform was found. Mr. Denger explained that chloroform can result from the chlorination process. Carbon filters contribute carbon which reacts with chlorine to form chloroform. The chloroform level in water coming from both Beavercreek well fields was below the allowable limit of 100 ppb.

Mr. Denger remarked that the Beavercreek public water supply is "pretty good now, but that further development could cause problems." Of special concern is development in the area of Research Park which could endanger the South Beavercreek well field.

Mr. Denger supplied the BCWTF with a list of users of the Beavercreek and Sugarcreek sewage treatment plants. The Sanitary

Engineering Department monitors the discharges of industrial users that are tied to the sewer treatment plants. Industries which discharge minor pollutants are tested annually, while those that discharge major pollutants are checked twice a year. Both the Beavercreek Sewage Treatment Plant and the Sugarcreek Sewage Treatment Plant discharge into the Little Miami River. The Eastern Regional Sewage Treatment Plant is under the jurisdiction of the Montgomery County although it discharges into the Little Beaver Creek. Mr. Denger commented that over half the flow into the Little Beaver Creek during the summer months is from Delco Division of General Motors, located in Kettering. The Eastern Regional facilities are being expanded with a completion date set for 1989.

As described by Mr. Denger, the sewage treatment plants are exclusively biological waste treatment systems. He maintained that the plant can be disabled by one large slug of toxicant entering the system; therefore, if the plant is alerted that a release has occurred, treatment will be bypassed in order to maintain the operating system. This can result in a significant amount of raw untreated waste being released directly into surface water.

On November 6, 1985, Mr. Jim Lukens from the Greene County Combined General Health District spoke to the BCWTF. He explained that the Health District is regulated by the State of Ohio and funded by four cities: Beavercreek, Bellbrook, Xenia and Fairborn and Greene County. According to Mr. Lukens, the Health District's jurisdiction covers septic tanks and private water supplies. These water supplies are defined as those having less than 15 service connections and serving less than 25 persons 65 days per year. Quasi-public supplies, such as the well which serves the Beaver Valley Shopping Center, are governed by OEPA and the Health District.

Mr. Lukens voiced several concerns regarding groundwater contamination. He explained that wells which are capped with outdated buried rubber seals are dangerous. The rubber can deteriorate forming the toxic chemical butadiene which then contaminates the groundwater. Also, once the seals are broken, contaminants can easily enter the well and flow into the aquifer. A major concern is that the aquifer is "poked full of holes". Mr. Lukens explained that a loophole in the law allows "abandoned" wells to remain unfilled if they are kept for purposes such as watering lawns. Abandoned wells serve as direct channels from the surface to the aquifer bypassing the biodegradation processes provided by soil filtration. A similar danger of pollution from corroded casings exists; another danger is buried domestic fuel oil tanks which may allow fuel oil to seep deeper into the ground.

Another major concern discussed by Mr. Lukens is the WBAFB Area B site of an inactive landfill which is situated directly over the largest aquifer in the area. However, the impact of this on Beavercreek groundwater is unknown.

Storage and handling of hazardous materials was the topic of the BCWTF meeting on November 13, 1985. Three members of the Beavercreek Fire Department, Chief Tom Perk, Captain Kip Smith, and

Inspector Greg Connors described how hazardous materials are controlled. The hazardous material regulations fall under the Ohio Fire Code which is state law. Ohio Fire Code references the National Fire Code and works in conjunction with the Ohio Basic Building Code. The fire officials stressed that local enforcement procedures are needed so that the laws can be enforced on a local level. Several local industries which handle hazardous material were discussed. Ohio Sealer (Riverain Corp.) and Elano, both of which are in close proximity to the aquifer, were commended by the fire officials for currently performing better than EPA standards. The Fire Department officials also showed a videotape of the Kohnen and Lammers Inc. "barrel factory" fire of 1969.

Beavercreek's representatives to the Greene County Board of Health, Mary Clark and Eric Gartz, attended the BCWTF meeting on December 18, 1985. They explained that the Ohio Revised Code is the source of mandatory service that the Greene County Health District provides. The Board members described the hazardous chemical pollution of private wells as "falling in a gap". They explained that the Health District has jurisdiction over private wells but only performs coliform bacteria testing. The OEPA performs chemical testing but does not have jurisdiction over private wells. The loophole exists primarily because the problem had never been an issue before the summer of 1985. Clark reported that the consensus of the Board members was not to become involved with the regulation of chemicals pertaining to water contamination. However, the Health

District does assume responsibility when blood tests are recommended for citizens who have consumed contaminated water.

The City of Beavercreek's responsibilities in matters of public health, safety, and welfare were discussed on February 19, 1986 with City Manager Steve Stapleton, and Zoning Inspector/Planner Jim Stevens. They explained that the Greene County Health District performs health and safety functions, as needed, for the city on a cost reimbursement program. Because the city has very limited resources for handling major pollution incidents, Beavercreek relies on the Miami Valley Civil Defense Disaster Services Agency and the Dayton Fire Department Hazardous Materials Team. The city officials explained that maximum efficiency is achieved by pooling the area resources in time of crisis.

V. INDUSTRIAL AND COMMERCIAL SURVEY

During November of 1985, when the groundwater situation in Beavercreek was in a crisis stage, the BCWTF initiated an effort to determine industrial and commercial usage of chemicals as a means of determining potential environmental hazards which may affect groundwater quality for the entire township.

In defining this effort, the idea for conducting an environmental audit, township wide, of industrial and commercial establishments was adopted.

The Task Force designed and published survey forms requesting information such as general data, products, operations, raw materials, storage and disposal, underground storage tanks, well water use, public or private waste water discharge, etc. A sample form is attached (Appendix 2). The BCWTF selected over 200 establishments to survey and forms were mailed by the City of Beavercreek with a cover letter from the City's Vice Mayor explaining the scope and purpose of this project (Appendix 3).

Seventy-three establishments responded to the survey (Appendix 4). Major findings were tabulated and analyzed as follows.

	Number	% of Respondents
A. Number establishments using chemicals	33	45
B. Number having well water	59	80
C. Number having public water	14	20
D. Number having public water (Sewer)	51	70
E. Number having septic tanks	21	30
F. Number having both public water and public discharge (Sewer)	16	20
G. Number having well and septic tank	9	10
H. Number having well and public discharge (Sewer)	50	70
I. Number of establishments having storage tanks	29	40
J. Range of liquid chemical or fuel stored per location (gallon)	200-80,000	
K. Number having wells and underground storage tanks	16	20
L. Number of active underground and above ground storage tanks	123	

From this data it is evident that a significant potential exists for chemical contamination of the aquifer from leaking underground storage tanks. Large quantities of chemicals or fuel are stored in concentrated locations with several of these locations in prominent aquifer recharge zones. Additionally, 45% of the respondents said chemicals in various quantities were utilized in their business. With the potential for accidental spillage, leaking tanks, and discharge into septic tanks, there is a significant potential for contamination of the aquifer.

VI. CONTAMINATION INCIDENTS: SHADYBROOK PLAT, E. PATTERSON ROAD, ROME BEAUTY DRIVE, ALPHA

In early August of 1985, water wells belonging to Ankeney Engraving and Nu-Glo Laboratories, along Dayton-Xenia Road were found to be contaminated with trichloroethane, dichloroethane, dichloroethene, and butadiene. Trichloroethane is known to cause liver and kidney damage. Trichloroethane, dichloroethene, and dichloroethane are similar in composition. Butadiene is a rubber compound.

Residents were notified by a representative from the Greene County Health District, who took the initiative to check the neighborhood to see if any warning had been issued. Residents had not previously been informed of any possible contamination. Residents, alarmed by the lack of information, decided to have their wells tested at their own expense. Originally the Health Department responded negatively to their request for testing, claiming a lack of funds, but due to the determination of the residents and media attention, the Health District decided to fund the testing of approximately 45 homes in the Shadybrook Plat. Results showed two of the wells tested had 1.1 ppb and 1.3 ppb of trichloroethane and two other wells showed less than a trace. "Trace" was defined as anything under 1.0 ppb. The EPA's safe threshold for trichloroethane is 1,000 ppb.

Testing of soil samples taken in early October from behind the Nu-Glo site showed the presence of trichloroethene and dichloroethene at levels as high as 3,500 ppb. This was termed a "significant" level by EPA specialists. Samples taken at 6-12 inches and 18-24 inches below the soil surface showed levels of 3,460 ppb trichloroethene and 12,300 ppb of dichloroethene, respectively. The Technical Assistance Team (TAT), which took the soil samples, is now in the final stages of making their report on the situation.

The poorly conducted Shadybrook Plat sampling and information dissemination caused distrust for city leaders, regulatory agencies and health officials among residents in the affected area. Residents felt the information about the wells on Dayton-Xenia was withheld too long, and they would never had been notified had it not been for the city's representative to the Health District. Nu-Glo was closed temporarily by the Fire Department, but it is once again in operation. Nu-Glo voluntarily moved its chemical mixing process to Xenia.

Residents of Shadybrook recall in past years that a stream which flows through the plat had turned red and even sudsy at different times. They now express deep concern over what may have been contamination of the ground water over a long period of time.

As a result of the Shadybrook incident, several residents on East Patterson Road became concerned over the safety of their own drinking water. These concerned residents submitted samples to a private lab in mid October 1985. One sample came back negative at that time, and the other had chloroethane detected at 35 ppb and dichloroethylene at 3.8 ppb. The Ohio EPA was alerted and submitted follow-up samples of well water to the Ohio Department of Health for analysis. A third EPA sample analyzed by PEI Laboratories in Cincinnati confirmed the presence of vinyl chloride. Residents who lived in the affected area were warned not to use their water for drinking or bathing. The maximum safe level for vinyl chloride at that time was 1.0 ppb. Vinyl chloride is a potential carcinogen and can cause liver damage. It is a chemical component of polyvinyl chloride, a common plastic.

Shortly after the vinyl chloride discovery, the U.S. EPA released Superfund money to the Greene County Sanitary Engineering Department to install public water to those residents with affected wells. The lack of complete information about the extent of contamination in this area resulted in incomplete public water service in the affected area. However, the overall performance of those concerned with the Patterson Road incident was commendable.

A possible source of contamination for this episode is the old Kohnen-Lammers Inc. site, a barrel reclamation factory, on the northeast corner of Patterson Road and Grange Hall Road which burned September 30, 1969. The factory stored 300,000-400,000 gallons of various chemicals in barrels and vertical tanks. Barrels were cleaned and reconditioned at the site. It is believed the fire started when employees were unloading methyl-ethyl-ketone from a barrel. This caused a fire and explosion that shot barrels hundreds of feet into the air. The debris from the fire was taken to a site on Fairfield Road near the intersection of Shakertown Road and buried. The EPA checked this latter site in 1980 and found no contamination.

In the early 1970's a B & O railroad train derailment occurred between Spaulding and Grange Hall Roads. This accident occurred when a tanker carrying acrylonitrile ruptured then burned near the Little Beaver Creek. The EPA was on the scene and sampled water down stream in the creek and from monitor wells. They concluded no contamination was present.

Another suspected source of general contamination is spillage from two vertical tanks storing diesel fuel at the Liberal Meat Packing Plant on Grange Hall Road. It was suspected these tanks were tampered with by disgruntled employees in 1979. Several thousand gallons of diesel fuel spilled onto the ground and flowed into a bog and seeped into the Little Beaver Creek. The spill material was soaked up and hauled away.

As a result of water contamination in the Shadybrook Plat and East Patterson Road, city officials and a local laboratory made water test kits available. Several press conferences and meetings were held to answer questions from concerned Beavercreek residents. A Hotline emergency telephone number was also established.

In early December trichloroethlyene (TCE) was discovered in three wells on Rome Beauty Drive. TCE is used as a metal degreaser, dry cleaning solvent, septic tank cleaner, fumigant, and a refrigerant. This area previously had septic tanks but presently has public sewer. Trichloroethylene can cause central nervous system disorders. Subsequent sampling showed contamination limited and of little general consequence.

In early January a well in Alpha was found to contain 1.6 ppb dichloroethane, 4 ppb cis-1,2-dichloroethene, and 12.6 ppb trichloroethane, all of which had been previously reported in contaminated wells from other parts of the city. In late January during a test of wells in Alpha, three more wells were found to have contamination, including one which showed TCE at 210 ppb. All Alpha contamination was in shallow wells. The sources of contamination for this area are under investigation, and Ohio EPA believes legal action will be taken in the near future.

In summary, three local areas have been found to have significant contamination. Specific sources have been tentatively identified for two of these areas, and there is evidence to implicate the source at the third location.

VII. POTENTIAL SOURCES OF GROUNDWATER POLLUTION

A. UNDERGROUND STORAGE TANKS

All containers with environmentally endangering materials are potential pollution sources. Underground tanks can pose more of a hazard because they cannot be readily observed and are closer to the aquifer. Slow leaks can go for long periods of time without being detected, especially if the tank is frequently used. New EPA regulations, an amendment to the Resource Conservation and Recovery Act (RCRA), require that all existing underground tanks must be registered by May 8, 1986 with a state or local agency. In Ohio it is the Ohio State Fire Marshall. All underground tanks abandoned after January 1, 1974 but still in the ground, must also be registered by May 8, 1986. Failure to comply would subject the owner to a $10,000 per tank per day federal civil penalty. Ohio Fire Prevention Code 1301:7-7-29 requires inventory records for underground storage of flammable and combustible liquids. The operator shall record all meter totalizer readings, immediately gauge and record all tank measurements and balance inventory and product transferred. The operator shall check all tanks for water no less than once a week. Each underground tank storing hazardous substances and petroleum products must conform to this Ohio Inventory Rule or the establishment is subject to being closed by the fire authorities and those responsible for the violation subject to civil penalties.

A provision banning underground installation of unprotected new tanks went into effect May 7, 1985. No person may install an underground storage tank unless:

It will prevent releases of the stored substances due to corrosion or structural failure for the life of the tank.

and

It is cathodically protected against corrosion; or constructed of noncorrosive material; or steel clad with noncorrosive material; or designed to prevent the release or threatened release of stored substances.

and

The material used in the construction or lining of the tank is compatible with the substance to be stored.

The maximum penalty is $10,000 per tank for each day this provision is violated.

Under new RCRA provisions, EPA must develop and promulgate performance standards for new tanks, as well as standards covering leak detection, leak prevention, and corrective action for both new and existing underground storage tanks. The schedules are different for petroleum tanks and hazardous chemicals tanks.

	Petroleum	Hazardous Chemicals
:andards for new tanks	Feb 1986	Aug 1987
ǝgulation concerning leak ǝtection/prevention and ɔrrective action	Feb 1987	Aug 1988
tudy and report to Congress	Nov 1985	Nov 1987

The law specifies that the leak detection/prevention and orrective action regulations must require owners/operators of nderground storage tanks to:

1. Have methods for detecting releases.
2. Keep records of the methods.
3. Take corrective action when leaks occur.
4. Report leaks and corrective actions taken.
5. Provide for proper closure of tanks.
6. Provide evidence as EPA deems necessary of financial responsibility for taking corrective action and compensating third parties for injury or damages from sudden or non-sudden releases.

Federal and state personnel are authorized to request pertinent ıformation from tank owners, inspect and sample tanks, and monitor and test tanks and surrounding soils, air, surface water, and ground water.

B. OTHER SOURCES OF GROUNDWATER POLLUTION

Second to underground storage tanks as a threat to the ground water are landfills, waste dumping, and lakes formed by action of mining sand and gravel. Landfills, such as the now closed one on Hawker Road and the Fairborn City Landfill, have unknown contents. Industrial dumping is suspected in at least one of the three current crisis areas in the city. Sand and gravel pits are directly linked to the aquifer. The water in such pits is part of the aquifer water supply. Substances that enter such a pit will eventually infiltrate the aquifer.

Many other sources have potential to cause damage to the aquifer. These sources are summarized in Appendix 5.

VIII. SUMMARY OF CHEMICAL TESTING

When the Task Force first formed, there was strong opinion that a baseline chemical characterization of well water quality throughout the Beavercreek area was needed. Although it was thought desirable, there was no way to fund such an extensive effort. After the discovery of the well water contamination on E. Patterson Road, the City of Beavercreek encouraged citizens to have their well water tested. As a result, over 500 wells were tested with a good spatial distribution to adequately cover the entire city. These samples, along with those taken by the Ohio EPA and the Greene County Health District are shown in summary form in Appendix 8. A map showing the distribution and nature of the contaminant is Appendix 7. The primary chemicals of interest were volatile organic compounds (VOC). This interest arose because of the contamination at the three identified sites. It was recognized that the analyses did not reflect the total contamination picture but was thought to be most beneficial in characterizing the problem. The samples do not represent a scientific approach to characterizing the Beavercreek ground water since accompanying well depth data are not available, but in our opinion it is sufficient to provide a baseline from which to work.

Approximately fifteen discrete VOC's were detected in various samples with no single compound common to all sampling sites. As stated by the Wright State University report, (Appendix 6) this implies that the sources and type of contamination are localized and probably unrelated. The Wright State conclusion was that the analyses were inadequate due to lack of replicate samples and lack of quality assurance data. The BGWTF disagrees with the Wright State conclusion in that it is our assertion that the presence of VOC contamination in however small concentrations constitutes a contamination problem. The interest of the Task Force was not so much in the quantitative assessment of contamination but qualitatively as to the presence of VOC's.

In summary, the analyses show VOCs are localized in three areas with some scattered individual well contamination. There appears to be no widespread contamination of the aquifer as evidenced by the lack of more general well contamination.

IX. CONCLUSIONS

The general conclusion of the Clean Water Task Force is that Beavercreek, as a whole, has good drinking water. We probably have a greater knowledge of the quality of our underground water than any other city of comparable size in the State of Ohio. At the present time, public water supplies are totally unaffected by any contamination. However, this is not to imply that there are no problems. Listed below are some of the major conclusions the Task Force drew from this study and events of the past few months.

1. The most compelling conclusion that can be derived from this study is that Beavercreek has localized groundwater contamination at significant levels. The contamination, while significant in certain areas, is localized primarily in three discrete locations. These locations are the Shadybrook area, the E. Patterson Road area, and the Alpha area. These three sites appear to be unrelated except in their general time of discovery. There is no common thread among the chemical contaminants, and the three suspected sources are quite disparate. There is no reason to think there is a general contamination of the aquifer. This is especially true considering the results of over 500 well water samples which show an absence of

general contamination throughout the area. Only a few single well samples showed any level of volatile organic compounds.

2. Although there is chemical contamination in several locations in Beavercreek, which will probably require clean up, it is not a "doomsday" situation. It is technically feasible to clean all of the known pollution sites. Cleaning will require outside agency assistance since it will be expensive, and it may be technically challenging. EPA's Superfund may be available to supplement other funding, however, it may be years before Beavercreek can expect active assistance from EPA.

3. With the City of Beavercreek growing and maturing, and with the township population increasing, it is to be expected that greater emphasis on the environment should be exerted at the local level of government. As was clearly evidenced in the water contamination incident on Shadybrook and the subsequent crisis involving E. Patterson Road, the City of Beavercreek was ill-equipped and ill-prepared to handle the numerous concurrent problems associated with crisis management. The city played a passive role while the Greene County Health District, Greene County Sanitary Engineering Department, and Ohio EPA carried out their responsibilities without central coordination. Information was disseminated to the public from multiple sources. As a result, there was conflicting information being given to the media and released to the public. In fact, the city has been a minor participant in the affairs over the past 6 to 9 months. With the exception of the Vice Mayor, no city official is

an active participant in environmental matters and certainly no city official is in charge of the day to day oversight of environmental concerns within the city.

4. Events have shown there is a lack of environmental awareness by the majority of the citizens of Beavercreek. Although several hundred people have participated in various meetings and environment related activities, there is still a lack of fundamental understanding of many environmental issues and consequences. As evidenced by the question and responses in the various public meetings, there is a misunderstanding by--people on what constitutes health hazards, risk/benefit ratios, probability of carcinogenicity, acute illness, various regulatory limits, etc. It is also evident that health and regulatory officials do not explain highly technical terms and concepts in a manner that most people can readily comprehend. The result can be misunderstanding and mistrust.

5. There is a significant potential for future contamination of ground water from scattered landfills, industrial spills, and underground storage tanks. While new sources are being regulated, abandoned and unregulated landfills and abandoned tanks can lead to damage to the aquifer. Also, there are presently quantities of chemicals within the existing industrial/commercial sector that pose a potential for contaminating groundwater.

6. Several deficiencies were noted in regulatory requirements in Beavercreek which, if corrected, could protect or maintain water

quality. Among them are the lack of accountability for abandoned wells, septic tanks and old underground storage tanks. There are currently no requirements for private well testing for anything other than bacterial contamination. There are no local enforcement regulations of the Fire Code. There is no mechanism available to the city to gather data from commercial concerns regarding use and storage of hazardous materials. There are no local spill prevention and containment regulations. Additionally, Beavercreek has no money budgeted for environmental concerns.

X. RECOMMENDATIONS

A. The City should have a full-time Environmental Coordinator.

A full-time city employee should be assigned to administer an environmental protection program for the city and, if necessary, for the township. His duties would be to coordinate environmental matters with other entities, develop environmental ordinances, conduct public awareness programs, consult with land use planners, lead the crisis management team and generally implement environmental policy for the city.

One of his first undertakings should be to organize efforts to clean-up the three identified contamination sites. Included in this organization should be securing outside funding, coordinating various agency inputs, developing a plan, overseeing the technical effort and informing the public of the progress being made.

The environmental coordinator should be an experienced person with a background in bioenvironmental engineering, ecology, or environmental management.

B. <u>Beavercreek Should Take Immediate Action to Begin A Systematic Clean Up Of Identified Groundwater Contamination Sites.</u>

The City of Beavercreek, along with the township, should begin a systematic effort to affect the clean up of groundwater contamination sites previously identified. The environmental coordinator should take the lead in accomplishing this effort. The clean up program should begin with a thorough characterization of the area and a complete characterization of the contaminants. Hydrological characterization of the area is also a necessity. Technical efforts to remove or neutralize contaminants should await characterization of the chemicals so that optimum techniques can be employed. The Wright State University study provides a good baseline from which to develop a complete plan.

It is recognized that adequate funding can pose a substantial constraint on the City's ability to execute such a program. The total cost of clean up could possibly be several million dollars. Therefore, it is imperative that the environmental coordinator make it top priority to coordinate efforts among all participating organizations and agencies and secure adequate funding from various local, state, and federal sources. Priority of sites to be cleaned up should be based on the significance of the health hazard associated with the site, extensiveness of the site, and likelihood for the spread of contamination within the aquifer.

C. Fire Code/ Enforcement Regulation Should Be Developed To Give the Local Fire Department Regulatory and Enforcement Authority For Hazardous Materials Storage and Handling.

The Fire Department has considerable knowledge of the liquids stored in the community which can pollute the aquifer if spilled. Much of this knowledge comes from laws and regulations such as the BOCA Basic Fire Prevention Code which has been adopted by the city. One major and glaring drawback to the city use of the BOCA Code is the lack of local enforcement. Although, the BOCA Code has been in effect locally for a number of years, the city has not developed the mechanisms to make it enforceable. The two major items which are lacking are 1) the mechanisms for obtaining permits and the cost of the permits; and 2) the schedule of fines for failure to follow the BOCA Code. It is important that these be put into place to regulate storage and handling of hazardous materials to preclude any future damage to the aquifer.

D. Environmental Consequences Of Future Industrial Growth Should Be Of Primary Consideration In Land Use Planning And Zoning Regulations.

General guidelines to be used in planning should control industrial development over the aquifer areas. These areas are roughly the valleys associated with the Little Beaver Creek, the Beaver Creek and the Little Miami River. Possible groundwater contaminating industrial and commercial establishments along the aquifer flow line should be limited. If industrial and commercial development is permitted, stringent contamination prevention measures should be required. Potentially contaminating sources should be restricted to relatively higher elevation. Potentially contaminating sources should not be developed upstream of high density residential areas to prevent direct contamination of drinking water sources.

Industrial development should be strictly prohibited within a one mile radius of public well fields.

E. The City Should Make Every Attempt To Recover The Clean-Up Cost Of Groundwater Pollution From The Responsible Party.

The cost to the city and to the residents caused by the pollutants should be recovered from the responsible party. This includes the resident's cost of digging deeper wells, etc. The city should participate in all efforts to determine the still unidentified sources of the pollution and the responsible party or parties. After identification of the offender, legal action should be taken to recover the cost of the clean-up.

F. <u>The County Should Install Monitor Wells In The Area Of The Well Fields To Preclude Any Suprise Contamination Of The Public Water Supply.</u>

The focus of the entire study was to insure a safe water supply for the future. One of the limitations to this is the ability to identify pollution sources and remedy them before the pollution enters the public water supply. Currently, sampling is only done at the well fields themselves which means that by the time a problem is detected it will be too late to take action. The county should place a number of monitor wells around the well field at a distance determined by a sound geological study. These wells should be sampled at least annually. Monitor wells are constructed differently than conventional wells and are designed to sample water at all depths of the aquifer. With the use of many wells it is possible to have a warning so that the source of a contamination can be identified and rectified and the water in the well field held within safe limits.

G. The City Of Beavercreek Should Establish An Environmental Crisis Management Team.

The events surrounding the water situation have pointed out the need to develop and identify a team of city personnel that will in future emergency or crisis situations act as the focal point for all activities. This team should be comprised primarily of city employees with support from other government entities limited to those persons who possess unique skills and knowledge not available from the city. Another important consideration is the team must be as small as possible.

Team leadership should be the responsibility of the City Manager. This leadership position should give the City Manager the responsibility of building or putting together the team. As the leader, he will be responsible for formulating the overall policy and plan of action based on input from the team members. The manager will be the primary interface with the media and the public. It is important that the day to day efforts of the team be delegated to the team members selected by the manager. The team could be comprised of personnel from the Police Department, Zoning and Inspection offices and the Road Department.

One member should be the environmental coordinator. The individual filling this position should be a full-time employee of the Economic and Community Development department. This individual will be responsible for initiating and performing all of the day-to-day tasks of the team. The coordinator will inform other groups, organizations and agencies of the status of the situation, coordinate other department's and agency's input into solving the problem (s), and obtain support from outside sources in the way of information, services, or funds.

In summary, the City Manager will be responsible for building a team of primarily city employees to work on specific problems or problem areas. He will have ultimate responsibility and control over the actions of the team but will not necessarily be involved in activities required to implement the program. The City Manager will be the interface between the city, the public, and the media.

The team itself will be under the immediate direction of the environmental coordinator. His/her responsibilities will be to perform the tasks necessary to implement the program. The coordinator will be the primary interface between the city and other government entities or agencies and the primary link to the affected residents.

H. The Frequency Of Public Water System Testing Should Be Increased And Sample Analysis Should Be Expanded.

A plan for increasing the frequency of public water system monitoring is recommended to insure safe drinking water in the Beavercreek area. The increased cost of this monitoring plan is justified on the basis of increased protection of the health of the persons served by the system. The following plan applies to the Greene County North Beavercreek Water System and the Greene County South Beavercreek Water System.

The public water systems should continue to be sampled daily for chlorine and fluoride, once per week for iron, and nine times per month for coliform bacteria. The testing done for inorganic chemicals should be performed on a twice per year schedule and should include the following parameters:

1.	Nitrate/nitrite	6.	Cadmium
2.	Fluoride	7.	Chromium
3.	Sodium	8.	Lead
4.	Arsenic	9.	Mercury
5.	Barium	10.	Selenium
		11.	Silver

The testing for radioisotopes should be done on a once/year frequency and include Alpha radiation, Radium 226 and Radium 228.

Considering the agricultural nature of much of the area both past and present, testing for pesticides should be performed once/year.

Testing for volatile organic compounds/trihalomethanes should be performed three times/year. In addition, an annual analysis for major chemicals of concern in EPA's list of priority pollutants should be performed.

It is further recommended that the above prescribed testing be done on source water taken from monitor wells surrounding the well fields as well as from a free flowing tap.

In recognition of the public's right to know, test results should be published in newspapers of general circulation in the area served by the system. An explanation should be included which will enhance the general public's understanding of the significance of test results.

I. Abandoned Septic Tanks Should Be Filled Or Removed.

The County has not required the removal or filling in of septic tanks after sewers were installed in the Township. This generally is not a problem in residential sites but poses severe problems in commercial/business/industrial sites in that many of these tanks can still be attached to drain systems in the building and used for dumping hazardous chemicals. The City should enact an ordinance, with implementing regulations, to insure that all septic tanks are permanently disconnected and made inoperative for those establishments with both septic tanks and sanitary sewers. Responsibility for this should be a function of the City's environmental coordinator.

J. The City Should Establish An Environmental Advisory Board.

Because of the potential damage to the environment posed by future and present development, the city should establish an Environmental Advisory Board charged with making recommendations to all city departments and boards on issues related to water, air, and noise pollution. It is felt the city departments and boards are involved in many activities and responsibilities and are not able to adequately address environmental issues. The Environmental Advisory Board will provide a long range environmental perspective for development matters. One of the first projects for this Board would be to work on an Environmental Protection Ordinance for the city.

K. Abandoned Wells Should Be Filled And Sealed.

With the advent of the county water system came the abandonment of residential wells. These wells are direct conduits to the aquifer, and any pollution that enters the well casing will infiltrate the aquifer. The well seals will leak as they age and the casing will rust through. For this reason, abandoned wells should be filled with grout. A city ordinance with implementing regulations should be enacted.

L. <u>Beavercreek Should Initiate A Program to Locate And Identify Abandoned Underground Storage Tanks. Contents of These Tanks Should Be Removed or Neutralized.</u>

Under the fact finding sections, a number of items were presented relative to underground storage tanks. Some of the most important items are that there is a large number of storage vessels located in Beavercreek, and their contents may range from flammable to hazardous. From the 73 respondents, 123 tanks were reported. One encouraging fact is new EPA rules mandate all existing and new tanks must be registered with the State Fire Marshall and the state fire code specifies monitoring of tanks and fines for failure to follow the regulations. A major problem lies with tanks abandoned before 1974, which do not have to be registered. Such tanks usually contain some of the original chemicals, and these older tanks are slowly deteriorating. The City and Township should initiate a program to identify abandoned tanks and insure they are removed or the contents removed or neutralized. There has been no survey of abandoned tanks in Beavercreek so the number cannot be determined. But considering the large number of reported tanks in the Township, there are very likely a number of tanks abandoned prior to 1974. The best source for such information will be from citizens and business input. A request for such information to citizens group and through the press should produce the needed results. Responsibility for this project should be under the control of the City Manager, but work should be conducted by the newly established Environmental Coordinator.

M. An Aggressive Environmental Public Awareness Program Should Be Initiated.

An important step toward preventing future pollution problems would be to educate the public, and particularly children, through the schools. The project could be run similar to the bike safety program conducted by the police department. The Beavercreek News could play an important role by carrying articles about pollution prevention. Contests to develop slogans and posters could be initiated.

The cable television channel could be an effective vehicle for local updates and clean water safety tips. Video tapes could be made concerning protection of the groundwater. After airing tapes on TV, they could be made available to schools, churches, scouts, clubs, or organizations. The tapes could alert people as to what contaminants are and possible sources. The city's environmental coordinator would be the official responsible for this continuing effort.

APPENDIX 1

NATIONAL PRIMARY DRINKING WATER

REGULATIONS

APPENDIX 2

COMMERCIAL/INDUSTRIAL SURVEY

SDMS US EPA Region V

Imagery Insert Form

Some images in this document may be illegible or unavailable in SDMS. Please see reason(s) indicated below:

- [x] Illegible due to bad source documents. Image(s) in SDMS is equivalent to hard copy.

Specify Type of Document(s) / Comments:

SOME ILLEGIBLE PAGES

- [ ] Confidential Business Information (CBI).

This document contains highly sensitive information. Due to confidentiality, materials with such information are not available in SDMS. You may contact the EPA Superfund Records Manager if you wish to view this document.

Specify Type of Document(s) / Comments:

- [ ] Unscannable Material:

Oversized ____ or ____ Format.

Due to certain scanning equipment capability limitations, the document page(s) is not available in SDMS.

Specify Type of Document(s) / Comments:

- [ ] Document is available at the EPA Region 5 Records Center.

Specify Type of Document(s) / Comments:

?! BI ?ERCREEK

MAYOR MARC ?
Vice Mayor

TO: ALL COMMERCIAL INDUSTRIAL ?

FROM: Marc ?derosian
Vice Mayor

SUBJECT: QUESTIONNAIRE : WATER USAGE AN ?

Dear Sir:

A. you are probably aware, Beavercreek has recently exp?ed several incidences of ground water contamination. Currently, effort? are being made to investigate these problems plus efforts are also under? to identify the extent of ground water pollution.

As part of this larger effort, and to inventory township wide chemical usage, we are soliciting the assistance of all area businesses and industries. We would like for you to please take the time to respond to the enclosed questionnaire. We realize that not all questions apply to all businesses, but please try to be as complete as possible.

These data will be compiled by the Beavercreek Clean Water Task Force to provide an accurate picture of the overall non-residential water usage and chemical discharges within the city and township. These data, along with the already completed well water testing, should provide a complete picture of the current status of Beavercreek water.

We would like to have your response within 10 days of the receipt of the questionnaire. Your cooperation is greatly appreciated. If you have any questions please call Steve Erickson at 426-5100.

Sincerely,

Marc Harderosian
Marc Harderosian
Vice Mayor

alr

COMMERCIAL/INDUSTRIAL SURVEY
OF BEAVERCREEK, OHIO

This questionnaire is being sent to Commercial/Industrial establishments in Beavercreek. Not all questions may be applicable to every establishment. Please return this questionnaire in the enclosed envelope within 10 days of receipt.

A. GENERAL INFORMATION

Establishment Name: ____________

Mailing Address: ____________

Address of Premises: ____________

Person to Contact: ____________

Address: ____________

Authorized Rep. of Establishment: ____________

Title: ____________ Signature: ____________ Date: ____________

B. OPERATION DESCRIPTION

Principal products or services: ____________

____

Brief description of activities on premises: ____________

____

____

Raw material used: (If trade names are given, include basic constituents of compound if known): ____________

____

____

____

____

Catalysts, intermediate products used: ____________

____

Type of operation (check one): Batch ____________ Continuous ____________

Average number of employees per shift: 1st ____;2nd ____;3rd ____

Normal shifts each day: ____________ Normal days each week: ____________

Describe anticipated future expansion: ____________

____

WATER SUPPLY

st ... (e.g., ... well water, stream water, purchased water, ... etc.). ... cubic foot = 7.48 gallons

...	... MATED ...	QUANTITY, GALLONS
	...	

...escribe any ... ...ent (incl... ...treatment process in ...: ...including chemicals used ...

D. WASTEWATER DISCHARGE

Is all of the wastewater discha... into the public sewer system: ________ Yes, _______ No. If no, indicate where the wastewater is discharged and the approximate percentage of total.

DISCHARGE	PERCENTAGE OF TOTAL
Discharge Well	________
Sanitary Sewer	________
Storm Sewer	________
Stream	________
Septic Tank	________
Hauler	________
Other (specify)	________
TOTAL	________

Does your establishment have a National Pollutant Discharge Elimination System (NPDES) Permit: _____ Yes, ________ No;
If yes, describe the details: ______________________________

Do you have a septic tank: ____ Yes; ____ No. If yes, is it active ________ or inactive ______?

Do you treat your waste water prior to discharge? __________ Yes, ______No. If yes; (1), briefly describe the treatment processes:

(2), describe the residual materials and sludges:

(3), describe how you dispose of these residuals

Are hazardous (As defined by the EPA and RCRA) substances, materials, wastes or petroleum chemicals __________used, ______stored, ______transferred, _________discharged, or __________ disposed of at this site? If any answer is yes, describe substances, quantity and quality of these materials (Please enclose a copy of MSDS, Material Safety Data Sheet, for each RCRA reportable material):

For each above material, describe briefly how it is used, stored, transferred, discharged, or disposed: ____________________

____

____

____

____

____

____

____

____

Do you have spill prevention control measures implemented? ______Yes, ____No. If yes, describe briefly (include sorbent and neutralization materials): ____________________

____

____

Do you have monitor well(s)? _____Yes, ______No. If yes, attach a copy(ies) of last five reports.

Describe the general characterisitcs of your waste water discharge by checking the box(es) of the attached form. (Attachment 2)

Estimate the % of water supply used for processes __________, non processes (e.g., non contact cooling water) __________, and domestic waste _________.

Has your water supply been chemically tested: ____Yes, _____No. If yes, attach a copy of the most recent test results.

Has your waste water been chemically tested? ______. If yes, then indicate which of the following tests were performed:

Conventional P[illegible] ______Yes, _______No

Heavy Metal[illegible] ______Yes, _______No

Base Neutr[illegible] ______Yes, _______No

Acid Fract[illegible] ______Yes, _______No

Pesticide[illegible] ______Yes, _______No

Volatile [illegible] ______Yes, _______No

Please attach [illegible]

E. STORAGE

Do you have tanks, sumps, pits, ponds or lagoons used as storage containers? ____Yes, ____No. If yes, describe the type of storage containers and the material stored. ____________

____

____

____

____

Are storage tanks:

a. underground ____________, above ground ____________

b. in use __________, inactive/abandoned ____________

c. number of tanks ____________

d. total capacity ____________

e. tank material ____________

f. tank wall thickness ____________

g. internal protection __________, external protection ____

h. leak detection system ____________

i. integrity testing,

   [illegible]t tested ____________

   [illegible] method ____________

[illegible] of repair ____________

[illegible] leaks in last 5 years ____________

[illegible] ____________

[illegible] ____________

[illegible] chemicals? ______Yes. ______No.

[illegible] rials and [illegible]ntities ____________

____

____

Attachment 1

Please pla[illegible]
business o[illegible] are dis[illegible]

___ acenap[illegible]
___ acrole[illegible]
___ acrylon[illegible]
___ benzene
___ benzidine
___ carbon [illegible]chloride
(tetr[illegible]omethane)

Chlorinated Benzenes
(other than dichlorobenzenes)

___ chlorobenzene
___ 1, 2, 4-trichlorobenze[illegible]
___ hexachlorobenzene

Chlorinated Ethanes

___ 1, 2-dichloroethane
___ 1, 1, 1-trichloroethane
___ hexachloroethane
___ 1, 1-dichloroethane
___ 1, 1, 2-trichloroethane
___ 1, 1, 2, 2-tetrachloroethane
___ chloroethane

Chloroalkyl Ethers

___ bis(2-chloroethyl) ether
___ 2-chloroethylvinyl ether (mixed)

Chlorinated Naphthalene

___ 2-chloronaphthalene

Chlorinated Phenols
(some are listed elsewhere)

___ 2, 4, 6-trichlorophenol
___ parachlorometa cresol
___ chloroform (trichloromethane)
___ 2-chlorophenol

Dichlorobenzenes

___ 1, 2-dichlorobenzene
___ 1, 3-dichlorobenzene
___ 1, 4-dichlorobenzene

___ Proprietary Materials

[illegible]

___ [illegible]benzidine

Dichloroethylenes

___ 1, 1-dichloroethylene
___ 1, 2-trans-dichloroethylene
___ [illegible], 4-dichlorophenol

Dichloropropane and Dichloropropene

___ 1, 2-dichloropropane
___ 1, 2-dichloropropylene
(1, 3-dichloropropylene)
___ 2, ~~4~~-dimethylphenol

Dinitrotoluene

___ 2, 4-dinitrotoluene
___ 2, 6-dinitrotoluene
___ 1, 2-diphenylhydrazine
___ ethylbenzene
___ fluoranthene

Haloethers
(some are listed elsewhere)

___ 4-chlorophenylphenyl ether
___ 4-bromophenylphenyl ether
___ bis(2-chloroisopropyl) ether
___ bis(2-chloroethoxy) methane

Halomethanes
(some are listed elsewhere)

___ methylene chloride (dichloromethane)
___ methyl chloride (chloromethane)
___ methyl bromide (bromomethane)
___ bromoform (tribromomethane)
___ dichlorobromomethane
___ chlorodibromomethane
___ hexachlorobutadiene
___ hexachlorocyclopentadiene
___ isophorone
___ naphthalene
___ nitrobenzene

Attachment 1 (continued)

[illegible]

...ophenol
...rophenol
...-dinitrophenol
...6-dinitro-o-cresol

Nitrosamines

N-nitrosodimethylamine
N-nitrosodiphenylamine
N-nitrosodi-n-propylamine
pentachlorophenol
phenol

Phthalate Esters

bis(2-ethylhexyl) phthalate
butyl benzyl phthalate
di-n-butyl phthalate
di-n-octyl phthalate
diethyl phthalate
dimethyl phthalate

Polynuclear Aromatic Hydrocarbons

benzo(a)anthracene (1, 2-benzanthracene)
benzo(a)pyrene (3, 4-benzopyrene)
3, 4-benzofluoranthene
benzo(k)fluoranthane (11, 12-benzofluoranthene)
chrysene
acenaphthylene
anthracene
benzo(ghi)perylene (1, 12-benzoperylene)
fluorene
phenanthrene
dibenzo(a,h)anthracene (1, 2, 5, 6-dibenzanthracene)
indeno(1, 2, 3-cy)pyrene (2, 3-o-phenylenepyrene)
pyrene
tetrachloroethylene
toluene
trichloroethylene
vinyl chloride (chloroethylene)

Pesticides and Metabolites

aldrine
dieldrin
chlordane (technical mixture and metabolites)

[illegible]

...DE
...DD

[illegible]

...sulfan
...-endosulfan
endosulfan sulfate

...and Metabolites

...ne
...aldehyde

Heptachlor and [illegible]

heptachlor
heptachlor epoxide

Hexachlorocyclohexane

a-BHC-Alpha
b-BHC-Beta
4-BHC (lindane)-Gamma
g-BHC-Delta

Polychlorinated Biphenyls (PCB's)

PCB-1242 (Arochlor 1242)
PCB-1254 (Arochlor 1254)
PCB-1221 (Arochlor 1221)
PCB-1232 (Arochlor 1232)
PCB-1248 (Arochlor 1248)
PCB-1260 (Arochlor 1260)
PCB-1016 (Arochlor 1016)
toxaphene

antimony (total)
arsenic (total)
asbestos (fibrous)
beryllium (total)
cadmium (total)
chromium (total)
copper (total)
cyanide (total)
lead (total)
mercury (total)
nickel (total)
selenium (total)
silver (total)
thallium (total)
zinc (total)
2, 3, 7, 8-tetrachlorodibenzo-p-dioxin (TCDD)

APPENDIX 3

MAILING LIST FOR SURVEY

Ko... ...ligh...
26... ...Xenia Rd.
Xe... ... 45385

Wick... Lumber Co.
Rt. ... at Orchard Ln.
Alpha ... Ohio 45301

Phillip... Sand & Gravel
20... ... Rt. 35
Al... Ohio 45301

...aco Transmission
Rt. 35 at Orchard Ln.
Alpha ... 45301

S.R.L.
...80... Indian Ripple Rd.

Bis...o
245... Dayton-Xenia Rd.
Xenia, Ohio 45385

Systech Corp
245 N. Valley Rd.
Xenia, Ohio 45385

Greene Co. Airport
140 N. Valley Rd.
Xenia, Ohio 45385

Perry & Derrick
1290 N. Fairfield Rd.
Xenia, Ohio 45385

Main Auto Parts
1314 N. Fairfield Rd.
Xenia, Ohio 45385

Geniune Auto Parts
4448 Indian Ripple Rd.
Beavercreek, Ohio 45440

Astro Industrials
4403 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

U.E.S.
4401 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

...
...50 Orchard ...
...Alpha, Ohio 45...

...
...570 Orchard Ln.
A... Ohio 45...

Knol... ...ood Garden C...ter
376... Dayton Xenia Rd.
Beav...reek Ohio 454...

Dun... ...Hdw.
337... Dayton-Xenia Rd.
Beavercreek, ...io 454...

...aytona M...lls
1148 N. ...airfield Rd.
Beaver...k Ohio 454...

Batter... ...House
4092 Ind...rial Ln.
Beavercre... Ohio 4543...

Bergamo
4435 E. Patterson Rd.
Beavercreek, Ohio 45430

Koogler-Suburban
4080 Industrial Ln.
Beavercreek, Ohio 45430

Delaney Oil Co.
1445 Lemcke Dr.
Xenia, Ohio 45385

Universal Technology Corp.
1270 N. Fairfield Rd.
Beavercreek, Ohio 45432

Sonoco Products
761 Space Dr.
Xenia, Ohio 45385

Technology Incorporated
3821 Col. Glenn Hwy.
Fairborn, Ohio 45324

M.J. Daly Co.
Orchard Ln.
Alpha, Ohio 453

K-Mart
4080 Indian Ripple R
Beavercreek, Ohio

Beavercreek News
1342 N. Fairfield
Beavercreek, Ohi 4542

Clints Printing
3953 Rockfield Dr.
Beavercreek, Ohio

Edwards Printing
1138 Richfield
Beavercreek, Ohio 45430

A.C. Hadley Printing
1530 Marselta
Beavercreek, Ohio 45432

Harold J. Becker Co.
3946 Indian Ripple Rd.
Beavercreek, Ohio 45440

Holandia Swimming Pool Co.
2309 N. Fairfield Rd.
Beavercreek, Ohio 45431

Loxely Bros.
2393 Phil Hubbel Dr.
Alpha, Ohio 45301

Gulf Oil
1331 N. Fairfield Rd.
Beavercreek, Ohio 45432

Steves Sunoco
4497 Indian Ripple
Beavercreek, Ohio 45440

Lindons Gulf Service Station
3999 E. Patterson Rd.
Beavercreek, Ohio 45430

Lofinos #2
3245 E. Patterson Rd.
Beavercreek, Ohio 45430

Imperial Bo
4100 Industr
Beavercreek, Oh

Jimick's Body Sh
4130 Industria Ln.
Beavercreek, Ohio 4543

Dave Dennis Volkswagon
4232 Col. G. Hwy.
Beavercreek, Ohio

Fy Auto Parts
1166 Richfield
Beavercreek

Fy Hdw.
1166 Richfield
Beavercreek,

Performance C
3870 Indian Ri
Beavercreek, O

Jim's Guns and
1148 Richfield
Beavercreek, Ohi 5430

Lauda's Gun City
1144 Richfield
Beavercreek, Ohio 45430

Optical Fashion
1395 Research Park Dr.
Beavrcreek, Ohio 45432

Clark Oil
4017 Col. Glenn Hwy.
Beavercreek, Ohio 45431

Speedway
2254 N. Fairfield
Beavercreek, Ohio 45431

Coast to Coast Hdw.
3251 E. Patterson Rd.
Beavercreek, Ohio 45430

M.T.L. Inc.
3481 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

...t... M ... it
...d Pact...
...enia. O...

...arboline C...
4162 Hel... ...d
Alpha, O... ...

Stop-N-...
3278 Ken... ...
Beavercreek... O... ...31

Leonard Auto Parts & Garage
4011 Dayton-Xenia Rd
Beaercreek, Ohio 45432

Sohio
Seajay & Fairfield
Beavercreek, Ohio 45430

Andy Sunoco-Beavercreek Sunoco
1326 N. Fairfield Rd.
Beavercreek, Ohio 45432

Automotive Parts & Machine Shop
3832 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

Toms Sohio
3815 Dayton-Xenia Rd.
Beavercreek, ohio 45432

Knollwood Marathon
3844 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

O'Kelly Co.
785 Factory Rd.
Xenia, Ohio 45385

Bean Bag City
819 Factory Rd.
Xenia, Ohio 45385

Beyer & Young
873 Factory Rd.
Xenia, Ohio 45385

Ohio Sealer Co.
1340 Grange Hall Rd.
Beavercreek, Ohio 45430

Ci...
159... ... Rd.
Xe... Ohio 45385

Si... Gas Station
22.6 Heller Rd.
Alpha, Ohio 45301

Dyer Knollwood Penzoil
3852 Dayton-Xenia Rd.
Beavercreek, Ohio 454...

Apple Valley Woodcrafts
4082 Datyon-Xenia Rd.
Beavercreek, Ohio 454...

Sohio
2998 Col. Glenn Hwy.
Beavercreek, Ohio 4543...

Capital Dry Cleaners
3798 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

Steck & Stevens
4014 E. Patterson Rd.
Beavercreek, Ohio 45430

Knollwood Hardware
3829 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

J & M Trailers
670 Factory Rd.
Xenia, Ohio 45385

Adams Electric Co.
819 Factory Rd.
Xenia, Ohio 45385

Duncan Oil Co.
Factory Rd.
Xenia, Ohio 45385

Super Valu Warehouse
1300 Grange Hall Rd.
Beavercreek, Ohio 45430

Carter Lumber
1312 Grange Hall Rd.
Beavercreek, Ohio 45430

[illegible]
[illegible] Ind[illegible]
Beavercre[illegible]

[illegible] Dayton-Xenia Rd.
Beavercreek, Ohio [illegible] 431

[illegible] W An[illegible]
[illegible] Grange [illegible] Rd.
Beavercree[illegible] [illegible]o [illegible]

Posts Instant Press
3[illegible] Patterson [illegible]
Be[illegible]v[illegible]reek, Ohio [illegible]5430

[illegible]arehouse [illegible] Cen[illegible]
[illegible]34[illegible] E. Pat[illegible]on [illegible]
[illegible]avercreek [illegible]hio [illegible]

E[illegible] [illegible] Ford
34[illegible] [illegible] Patterson Rd.
Beaver[illegible] [illegible]e[illegible]. O[illegible] 45430

Woodhaven [illegible] Club
3519 E. Pa[illegible]erson R[illegible]
Beavercree[illegible] [illegible]io 4[illegible]430

Johnni[illegible] C[illegible]rry[illegible]
398[illegible] [illegible] Rd.
Beaver[illegible]ree[illegible], O[illegible] 45430

Debco Valve Co.
819 Facto[illegible] Rd.
Xenia, Ohi[illegible] [illegible]385

Circle
38[illegible]
Beave[illegible] 45431

Ankeney Jr. High
408[illegible] Shakertown Rd.
Beavercreek, Ohio 45430

Beave[illegible] School
2660 [illegible] Rd.
Xenia, [illegible] [illegible]5385

Beavercreek Schools Central Offices
2940 Dayton-Xenia Rd
Xenia, Ohio 45385

Bevercreek Schools Maintanence Garage
2940 Dayton-Xenia Rd.
Xenia, Ohio 45385

Beavercreek Schools Transportation Dept.
2940 Dayton-Xenia Rd.
Xenia, Ohio 45385

Amerspand Antiques
T490 N. Fairfield
Beavercreek, Ohio 45432

Puckett's Antiques
2358 Dayton-Xenia Rd.
Xenia, Ohio 45385

Sunmpide Antiqes
2329 N. Fairfield Rd.
Beavercreek, Ohio 45431

Towpath Antiques
3838 Indian Ripple
Beavercreek, Ohio 45440

C.M. Saler Mfg.
1371 Dayton- Xenia Rd.
Xenia, Ohio 45385

Copeland Machinery & Supply
1438 Dayton-Xenia Rd.
Xenia, Ohio 45385

Timac Mfg. Co.
1211 Ankeney
Xenia, Ohio 45385

Airway Animal Clinic
4092 Colonel Glenn
Beavercreek, Ohio 45431

5604 Dayton-Xenia Rd.
Beavercreek, Ohio 454

Respiratory ...
2630 ...
Beavercreek, Ohio 4543

Mediat...
3572 Dayton-Xenia Rd.
Beav... Ohio 4543

Anderson Foundry
3555 Kemp Rd
Beavercreek, Ohio 45431

Ramac Sheet Metal
4236 Industrial Lane
Beavercreek, Ohio 45430

S & M Spring
2804 Shakertown
Xenia, Ohio 45385

Dale's Carpet Cleaner
3818 Skyline
Dayton, Ohio 45432

Beavercreek Emergency Clinic
3477 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

Johnny's Carpet Cleaning
3993 Willowcrest Rd.
Beavercreek, Ohic 45430

Larry Baberich
3204 Dayton-Xenia Rd.
Beavercreek, Ohio 45385

Houck & Hull Floor Sanding
3581 Colbourne
Beavercreek, Ohio 45430

Wright State Univ.
3640 Colonel Glenn
... Ohio 4543

...
... Research Park ...
Beavercreek ... 45432

Automet...
1388 Research ... Drive
Beavercreek, ... 45432

Whitt Ceramic
1548 N. ...
Beavercreek, ... 45432

Ceramic Worksh...
3866 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

Edward Cail
1516 Marsetta Dr.
Beavercreek, Ohio 45432

B & B Steam Cleaning
560 Carthage Dr.
Xenia, Ohio 45385

Sheriff Steam Cleaning
4130 Industrial Lane
Beavercreek, Ohio 45430

M & S Garage
1205 N. Fairfield
Beavercreek, Ohio 45432

Ele[illegible]
401 [illegible]on-Xe[illegible]
Be[illegible]re[illegible]k, Oh[illegible]

T[illegible]
3[illegible]
[illegible] 45440

Ta[illegible] Construc[illegible]
277[illegible] Snakertown
Xenia, Ohio 4538[illegible]

Automotive Wholesal[illegible] Repa[illegible]
674 Orchard Lane
Alpha, Ohio 45301

F & K Ceramic[illegible]
[illegible]417 Dayton-X[illegible]
[illegible] 45432

Motor Medic
1200 N. Fairfield
Beavercreek, Ohio [illegible]

Fo[illegible] C[illegible]eaners
[illegible]3[illegible]4 Grang[illegible] [illegible]all
[illegible]eav[illegible]rcree[illegible] Ohio 45431

Yearling Oil Co.
Orchard Lane
Alpha, Ohio 45301

[illegible] Medi[illegible] Products
[illegible]6 Indi[illegible] Ripple
[illegible] Ohio 45440

Carter Plumbing
1306 Grange Hall
Beavercreek, Ohio 45430

[illegible]ive
[illegible]field
[illegible], Ohio 45432

F & K Engraving
3141 Willow Bend
Xenia, Ohio 45385

Fo[illegible] [illegible]tomotive Service
41[illegible] [illegible]strial Lane
B[illegible]ck, Ohio 45430

Terminal Cold Storage
1300 Grange Hall
Beavercreek, Ohio 45430

Watki[illegible] Johnson Co.
2500 N[illegible]ional
Fairbo[illegible]n, Ohio 45324

Withrow's Welding
1571 N. Central
Beavercreek, Ohio 45432

Beck, William & Sons
1474 N. Fairfield
Beavercreek, Ohio 45432

Cherry Hill Garden Mart
3955 Indian Ripple
Beavercreek, Ohio 45440

Beavercreek Rental
4120 Industrial Lane
Beavercreek, Ohio 45430

Gerdes Landscaping & Turf Farm Inc.
1441 Upper Bellbrook
Xenia, Ohio 45385

Federated Metals Corp.
3393 Claydor
Beavercreek, Ohio 45431

K. Electronic
3987 Darden Dr.
Beavercreek, Ohio 45430

Miami Valley Processors Inc.
1615 Brook Lynn
Beavercreek, Ohio 45432

Monarch Eng. Mfg.
2642 Indian Ripple
Beavercreek, Ohio 45440

[illegible]
1275 Grange Hal.
Beavercreek Ohio [illegible]

Apple Valley Animal Hosp
1235 Grange Hall Rd.
Beavercreek, Ohio [illegible]

Harco Tool
4120 Industrial Lane
Beavercreek, Ohio 45430

Tramco Mold
4099 Industrial Lane
Beavercreek. Ohio 45430

Theraputic Technology Inc.
2776 Heller Dr.
Alpha, Ohio 45301

Deals Florist
3472 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

Ketco Inc.
1348 Research Park Drive
Beavercreek, Ohio 45432

Valley Asphalt
586 N. Valley
Xenia, Ohio 45385

Fullers Ceramics
3301 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

Mary's Ceramics
4156 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

Mouse House
2309 N. Fairfield
Beavercreek, Ohio 45431

Ceramic Hobby House
3862 Indian Ripple Rd.
Beavercreek, Ohio 45440

Odd Lots
1278 N. Fairfield
Beavercreek, Ohio 45432

[illegible]
[illegible]
Beavercreek, Ohio [illegible]32

[illegible] Garage
[illegible] N. Fairfield Rd.
Beavercreek, Ohio [illegible]32

Patton [illegible] Cleaner
3231 [illegible] Patterson Rd
Beavercreek, Ohio 45430

[illegible]yreal Co.
[illegible]55 Indian Ripple Rd.
Beavercreek, Ohio 45440

Ankeney Engraving
3455 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

Glawe M[illegible]ring Co.
2269 N. Fairfield Rd.
Beaverc[illegible] Ohio 45431

Sports [illegible] Center
4220 Co[illegible]
Beaverc[illegible] Ohio 45431

Thomas Son[illegible]
3970 Col. Glenn
Beavercreek, Ohio 45431

Beavercreek Florist
2173 N. Fairfield
Beavercreek, Ohio 45431

Tobias Funeral Home
3970 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

Chessman Lens
3337 Dayton-Xenia Rd.
Beavercreek, Ohio 45432

Franks Fruit Farm
4308 Kemp Rd.
Beavercreek, Ohio 45431

Ceramic Cottage
1436 Hanes Rd.
Xenia, Ohio 45385

es
Glenn Hwy
Ohio 4543

ew Co.
28 own
Xen 45385

Floor Sanding Co.
39
X Ohi 45385

Personalized Family Portraits
2 35 Cold Springs
Xenia, Ohio 45385

K Capet Cleaning
Knocks Dr.
creek, Ohio 45432

Michael's Quality
2943 McKay
Beavercreek, Ohio 45432

S & M Carpet Cleaning
3968 W. Fernwald
Beavercreek, Ohio 45440

Thur-O-Kleen
4414 Rosehill Dr.
Beavercreek, Ohio 45431

Patti-Maids
1440 Long Island Ct.
Xenia, Ohio 45385

Ms Neat & Tidy
1416 Old Towne Ct.
Xenia, Ohio 45385

High Speed Photography
2580 Green Hill
Fairborn, Ohio 45324

Ruffner Photog.
4 78 Dayton-
B creek io 45432

G phics
ield Dr.
k, Ohio 45430

Camera
1 32 stream
B ek, Ohio 45432

J & printing
3055 uthfield
Xenia, Ohio 45385

Taurian Photog.
1530 Marsetta
Beavercreek, Ohio 45432

Mighty-Maids
4088 Dayton-Xenia
Beavercreek, Ohio 45432

Camera Clinic
2355 El-Cid Dr.
Beavercreek, Ohio 45431

Fireside Photog.
1344 N. Fairfield
Beavercreek, Ohio 45432

APPENDIX 4

RESULTS OF SURVEY

[redacted] ALI [redacted] NT [redacted] [redacted] [redacted] IIV [redacted]

NAME	ADDRESS	PRODUCTS	RAW MATERIALS	SPI PERM EPS AIR	SOURCE	ANNUAL QUANTITY GAL.	DISCHARGE	%	WASTE	[illegible]	[illegible]	[illegible]
INEAN OIL	849 FAITUAY RD.	PETROLEUM WHOLESALE/RETAIL	GASOLINE, OIL KEROSENE		WELL BOTTLED	100,000 750	SEWER	100	FUEL MIXED WITH ABSORBANTS		17	U.S. [illegible]
RNEY Jr. HIGH	4085 SHAKERTOWN	EDUCATION			WELL		SEWER	100	LAB CHEMICALS			NONE
YSTEM RESEARCH	1834, 1842 MUS WOODS	ELECTRONIC AND R&D	STODDARD SOLVENT		PUBLIC	150,000	SEWER	100				NONE
[illegible] board J Lab	2940 DAYTON-XENIA	Education			Greene County Mont. " well	7,000,000 600,000 2,000,000	Sewer	100				
ECIAL AUTO REPAIR	4100 IND. LANE	Auto body repair Sandblasting	Sand Blasting - metal / wood		Well	29,120	Sewer	100				NONE
hio Sealer	1340 Grange Hall Rd	Ama sealant Caulk, Adhesives	Polyurethane, epoxy, vinyl plasticid chemicals, [illegible]	1	Public	300,000	Sa[illegible]				2	[illegible]
icker Lumber	Heller Road	Retail Building materials	wood and other building materials	1	Well	not known	Septic	100				
ALLEY ASPHALT CORP	U.S. 35 & VALLEY RD	HOT MIX ASPHALT PRODUCER	PROCESSED GRAVEL SAND, CEMENT	1	WELL	7500	SEPTIC	100	[illegible]			?
OBIAS FUNERAL	3970 DAYTON-XENIA	EMBALMING FUNERAL	EMBALMING AUTO	1	WELL		SEWER	100				
ECORATED METAL		ONLY SALES NO STOCK	CLOSED FOR BUSINESS									
UNSIDE STRIPPING	2329 N. FAIRFIELD	FURNITURE STRIPPING & REFINISHING	97 STRIPPER AND WATER NO WASH STRIPPER IN CANS	1	WELL	30 GALL.	2 SEPTIC [illegible]		[illegible]	[illegible]		[illegible]
ICKETT ANTIQUES	2358 DAYTON-XENIA	ANTIQUES SELL/REPAIR		1	WELL							
ODD LOTS	1278 N FAIRFIELD	GENERAL MERCHANDISE	NONE.	1	PUBLIC		SEWER					
STOP & GO	3278 KEMP RD.	STORE & GAS	FUEL KEROSENE MOTOR FUEL	3	PUBLIC	38,000	SEWER	100				
MARY'S CERAMICS	4156 DAYTON-XENIA		NO DATA									
S&M SPRING Co	2804 SHAKERTOWN	SPRINGS & WIRE FORMS	STEEL WIRE S.S. WIRE STRIP STEEL	1	PUBLIC	10,000	SEWER	100	NONE			NONE
AAMCO TRANSMISSION	US 35 & ORCHARD	REPAIR AUTO		1	WELL		SEPTIC	100	SOAP FLOOR DRY		5 FUEL 1	[illegible]
SONOCO PRODUCTS	761 SPACE DR. ALPHA	FIBER CAULK CARTRIDGES & CANS	PAPER, LINER METAL, ADHESIVES	2	WELL	75,000	SEPTIC	100				
NOVA CREATIVE	MOVED TO DAYTON											
WILLIAM ANKENY	3037 DAYTON-XENIA	ENGRAVING IN PLASTIC METAL, WOOD	PLASTIC, BRASS, ALUM. WOOD, ACID ETC	1	WELL		SEPTIC					NONE
WRIGHT STATE U.		DID NOT	ANSWER QUESTIONIER!		BECAUSE	UNIVERSITY	CONSIDERED		"NOT APPLICABLE" QUESTIONS!			
THERAPEUTIC TECH	7070 HELLER	REHABILITATION PRODUCT FOR SPINAL	NO CHEMICALS	1	WELL	1	PUBLIC					
HOMER'S GARAGE	1465 N FAIRFIELD	AUTO REPAIR SERVICE	OIL, BATTERIES		WELL	14,000	PUBLIC		OIL	[illegible]		NONE
F&F	462 CARDTAGE	ADVERTISING SERVICE	NONE- OFFICE WORK									
CARBOLINE	2150 HELLER	WAREHOUSE FIREPROOFING MATERIAL	DRY MATERIALS MAGNESIUM OXIDE, CALCIUM CARBONATE FIBER GLASS MAGNESIUM CHLORIDE	1	WELL	UNKNOWN	SEP[illegible]					NO[illegible]

ESTABLISHMENTS [redacted] ACTIVI[redacted] WATER [redacted] PPLY [redacted] OUT [redacted] DE[redacted]SITI [redacted]

No.	NAME	ADDRESS	PRODUCTS	RAW MATERIALS	SHIFTS	REMARKS	SOURCE	ANNUAL QUANTITY GAL.	[illegible]	[illegible]	[illegible]	SOURCE	NO.	CAPACITY	
1	V.W. AUTOMOTIVE	2276 GRANGE HALL	AUTO PARTS / SERVICE	NONE	1		GREENE CO.		STORM [illegible]	40	PARTS CLEANER	SAFETY KLEEN		NONE	
2	ASTRO IND.	4403 DAYTON-XENIA	ELECTRICAL WIRE	COPPER CONDUCTORS TEFLON POWER AND TAPES	2		WELL		[illegible]					NONE	
3	KNOLLWOOD HARDWARE	3819 DAYTON-XENIA	RETAIL HARDWARE	NONE			WELL	34,[illegible]	SEWER	100	N/A		3 FUEL	ABOVE GROUND 275 GAL.	
4	KNOLLWOOD FLORISTS	3766 DAYTON-XENIA	RAISE FLOWERS & PLANTS	SEEDS, PLANTS, SOIL FERTILIZERS			WELL	1,000,000	SEWER PLANT [illegible]	25 75	FERTILIZER	[illegible]	1 WATER	ABOVE GROUND 1,000 GAL.	
5	AUTO PARTS & MACH. SHOP	3832 DAYTON-XENIA	AUTO PARTS MACHINE SHOP	CHEMICALS FROM SAFETY KLEEN AND DUBOIS	1		WELL		SEWER	100	[illegible]	[illegible]		NONE	
6	APPLE VALLEY WOODCRAFT	4082 DAYTON-XENIA	WOOD WORKING AND FINISHING	SOLID WOOD FIBER BOARDS AND LACQUERS	1		PUBLIC		[illegible]	100	[illegible]			NONE	
7	EDWARDS PRINTING	1138 RICHFIELD CEN.	PRINTING		1		WELL	26,000	SEWER	100			2	A. [illegible]	
8	SOHIO OIL	3166 SEA SKY	GAS STATION	MOTOR FUEL	3		WELL	20,000	SEWER	100			4 GAS	U.[illegible]	FUEL HAS [illegible]
9	BONDED OIL	3991 INDIAN RIPPLE	GAS STATION FOOD STORE	MOTOR FUEL			PUBLIC	9,000	SEWER	100			3 GAS	U.G. [illegible]	
10	SOHIO OIL	3998 COL. GLENN	GAS STATION	MOTOR FUEL	3		PUBLIC		SEWER	100			5 GAS	41,550	
11	PIP	3297 E. PATTERSON	COPYING & PRINTING	N/A	3										
12	BERGAMO	4435 E. PATTERSON	CONFERENCE AND RETREATS	N/A	3		WELL	UNKNOWN	SEWER	100	SODIUM HYPOCHLORIDE [illegible]	[illegible]	6 [illegible]	A.G. [illegible] 26,[illegible]	
3	PHILLIPS SAND & GRAVEL	2000 U.S. 35	CONCRETE EXCAVATION	SAND, GRAVEL, CONCRETE, CAL. CHLORIDE	1		WELL SURFACE DOM. WELL	33,600,000 875,000 42,000	RECYCLED SEPTIC LAKE	1 99	STORAGE [illegible]	PONDS [illegible]	20	A.G. U.G. 26,000	
4	PERFORMANCE CLINIC	3870 INDIAN RIPPLE	AUTO PARTS AND SERVICE	METAL FOR MACHINING	1		PURCHASED	24,000	SEWER	100	WASTE OIL			U.G. [illegible]	
5	INTERSTATE BATTERY	4092 INDUSTRIAL LN	DISTRI. BATTERIES		1		WELL		SEWER	100			1 GAS	U.G. 550	
6	KUEGLER-SUBURBAN	4080 INDUSTRIAL LN	REFUSE COLLECTION		1		WELL		SEWER	100			GAS DIESEL	U.G. 12,800	
7	DUNNIGAN HARDWARE	3375 DAYTON XENIA	HARDWARE SELL	HARDWARE PRODUCTS			WELL	50,000	SEWER	[illegible]				NONE	
8	K-MART	4480 INDIAN RIPPLE	RETAIL	RETAIL PRODUCTS			PUBLIC		[illegible]	[illegible]				NONE	
9	BEAVER YOUNG INC.	873 FACTORY RD.	AUTO REPAIR	NONE	1		WELL		SEWER	100	OIL	EXCHANGE SAFETY KLEEN		NONE	
10	B AND B AUTOMOTIVE (MAIN AUTO)	1319 N FAIRFIELD	AUTO PARTS	LACQUER, ENAMEL, PAINT ETC.	1		[illegible]		SEWER	100				NONE	
1	BEAVERCREEK SUNOCO	1326 N. FAIRFIELD	GAS STATION CARRY OUT	MOTOR FUEL			WELL		SEWER	100			5 GAS KJ	U.G. 39,000	
12	LOXLEY BROS.	2393 PHIL HUBBELL	BODY SHOP	PAINTS AND REDUCERS	1		WELL		[illegible]						
13	KNOLLWOOD MARATHON	3844 DAYTON-XENIA	GAS STATION	MOTOR FUEL			WELL		SEWER	100			5	U.G. 17,000	
14	THE SAILER TAILOR	819 FACTORY RD.	BOAT COVERS BEAN BAG SOFT LUGGAGE	FABRIC OF POLYESTER, NYLON AND ACRYLIC			WELL	5,000	SEWER	100				NONE	
5	M. J. DALY	435 ORCHARD LN.	FUEL OIL DISTRIBUTOR	NO 1 AND NO. 2 FUEL OIL	1		WELL	3,000	SEPTIC	100	OIL		12	30,000	

#	NAME	ADDRESS	PRODUCTS	RAW MATERIALS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	CAPITAL DRY CLE	3798 DAYTON-XENIA	GARMENT DRY CLEAN	PERCHLOROETHYLENE		WELL			[illegible]		5 GAL ABOVE GROUND
	KETCO INC	1306 N. [illegible]	MODEL SHOP	METAL, WOOD FIBERGLASS	1	WELL	5200	[illegible]			[illegible]
	HIGH SPEED PHOTO.	2580 GREENE HILL	HIGH SPEED RENTAL SERVICE	EQUIPMENTS		—	NOT APPLICABLE →				
	BEAVERCREEK FAM. CLINIC	1473 DAYTON-XENIA	MEDICAL & MINOR SURGERY	NONE	3	WELL	300,000	SEWER			NONE
	UNIV. TECH	1616 (1270?) MARDEN	SERVICES ENGINEERING	PHOTO PROCESSING FIXER, BLEACH INK, SOLVENTS	1	PUBLIC	850,000	SEWER			12 GAL PHOTO [illegible]
	THOMAS SERVICE	3770 COL GLENN	AUTO SERVICE GASOLINE	GAS, OIL		WELL		SEWER 100		5	3-6000 GAS 1-2000 DIESEL 1-KERO. [illegible]
	CERAMIC COTTAGE	1836 HANES	CERAMIC PRODUCTS	GLAZES, CLAY STAINS		WELL		SEWER 100			
	NEAL'S FLOWERS	1412 DAYTON-XENIA	LANDSCAPE SERVICE			3 WELLS		SEWER			NONE
	KRAMER GRAPHICS	3775 RUSKFIELD	TYPESETTING ART PRODUCTION	FILM DEVELOPER FIXER		WELL	25,000	SEWER			NONE
	UNKNOWN	UNKNOWN	BRIDAL SALES	CLOTHES							
	ALPHA VET CLINIC	2515 DAYTON-XENIA	VET MEDICINE	MEDICINE FOR DOGS & CATS		WELL		WELL (STORMWATER) SEWER (TREATMENT)			250 GAL [illegible]
1	WM BECK & SONS	1474 N. FAIRFIELD	SALES SERVICE LAWN & GARDEN	PARTS		SEWER			OIL & GREASE HAUL AWAY	1	[illegible]
	BEAVERCREEK ANIMAL HOSP	3609 DAYTON-XENIA	SERVICE	VET CARE MEDICINE		WELL		SEWER			NONE
	TOW PATH ANTIQUES	1838 INDIAN RIPPLE	ANTIQUE COLLECTION	ANTIQUE		WELL		SEWER			
	SUPER VALU STORE	1300 GRANGE HALL	WAREHOUSE	WAREHOUSING MATERIAL		WELL		SEWER			
6	[illegible] SYSTEMS INC	3481 DAYTON-XENIA	COMPUTER SYSTEM & PHOTO PROCESSING	PHOTO MATERIAL R & D COMPUTER		WELL PUBLIC	1,050,000 [illegible]	SEWER			NONE
7	K ELECTRONICS INC	3987 DARDEN	ELECTRONIC PARTS PACKAGE	PACKAGING PRODUCTS		PUBLIC		[illegible]			[illegible]
8	CAREER PEN	1306 GRANGE HALL	RETAIL	RETAIL SALE		[illegible]					
9	NEW PANTORIUM CLEAN	3291 FAIRFIELD	DRYCLEAN	NO PRODUCTION							
0	BEAVERCREEK RENTAL	4119	RENTAL EQUIPMENT	EQUIPMENT		WELL		[illegible]			NONE (WELL [illegible])
	ANDERSON FOUNDRY	3157 KEMP RD.	CASTINGS	MOLDING ALUM, BRASS ALUMINA METAL		PUBLIC	65000				
2	CHERRY HILL LAWN	3935 INDIAN RIPPLE	LAWN MOWER SERVICE	MUFFLERS		WELL	18,250	SEWER			
3	RESPIRATORY & CLIN. SUPPLY	2690 [illegible]	MED. SERVICE (OXYGEN)	NO PRODUCTION							

APPENDIX 5

SOURCES OF GROUNDWATER CONTAMINATION

LAND USE-RELATED ACTIVITIES, THEIR POTENTIAL GROUNDWATER IMPACTS, AND RESPONSIBILITIES FOR THEIR CONTROL

Introduction

The purpose of this inquiry is to determine what role the local units of government which overlie or are adjacent to the Great Miami buried valley aquifer can appropriately play in a groundwater protection strategy for the aquifer based upon their planning and regulatory policies, practices, and responsibilities. The premise of the study is that certain activities (such as solid and liquid waste disposal, chemical storage, wastewater treatment, etc.), constitute potential sources of groundwater contamination (or impact factors) and that these are functions of various land uses over which primary local units of government (PLUGs) and other regulator entities, separately or in combination, have control or influence. It is this local government/groundwater connection that is being explored.

In order to make such an analysis, several preliminary steps are required. First, it is necessary to identify those activities and sources which may impact upon the groundwater resource and to relate them to general land use categories where they may occur. Second, it is essential to understand what connection each activity bears to the possible contamination of groundwater; i.e., to answer the question, "why is activity 'x' of concern?". Finally, it is necessary to gain insight into the regulatory framework, or control point network, which relates to each activity or source and exerts influence over it. For many activities, the control network is far from simple. It may consist of only local level regulations, practices or policies, but more likely it consists of these in combination with others at the special district, state or even federal level. Some understanding of this phenomenon provides a context for evaluating the local government role in groundwater protection, based upon the occurrence of various activities and sources in association with land use categories.

This chapter begins with a review of some forty-three potential pollutant activities/sources in relationship to nine general land use categories. It continues with an explanation of the significance of each activity/source in terms of groundwater contamination. The governmental levels which compose the regulatory framework or control point network for each are then identified. Finally, a listing of selected activities/sources by land use category is presented, which is used as the basis for the remainder of the research into local regulations, policies and practices of local government in relationship to groundwater protection, found in this report.

B. Potential Groundwater Pollutant Activities and Sources Related to Land Use

In considering the universe of activities and sources that may impact the groundwater resource in any given geographic area, it soon becomes apparent that the list is quite extensive. Indeed, it may well be endless, in light of the fact that new sources seem to develop continuously as a function of modern science and technology. For this study, and based upon a review of the literature, a list of more than forty such activities and sources was developed. While the list is not purported to be all inclusive, it is believed to cover most of the factors which may represent potential and/or actual impacts upon groundwater in the Miami Valley. These usually occur in association with one or more general land use categories. Table 2 which follows is intended to illustrate these relationships and to show that many activities/sources do occur across a number of land use categories. From the standpoint of local government control, it is also important to note that they may be functions of existing and/or future land uses, a dimension which has been incorporated into the regulations research which follows in Chapter V. An examination of Table 2, in the context of both current and future development, begins to provide a picture of the complexity of the groundwater protection issue from a land-use/potential-source standpoint.

C. Potential Groundwater Impacts of Various Related Sources and Activities

The activities and sources identified in Table 2 are considered to be potential contributors to groundwater pollution in either direct or indirect ways. In some cases, the connection is obvious, while in others it is far more obscure. Both these situations are illustrated by Figure 4, which traces contaminant routes from several kinds of solid and liquid waste disposal sites. In the discussions which follow, the significance of each of the sources and activities identified in Table 2 for groundwater contamination is examined.

TABLE [illegible]

POTENTIAL GROUNDWATER [illegible]LLUTANT SOURCES BY LAND USE CATEGORY

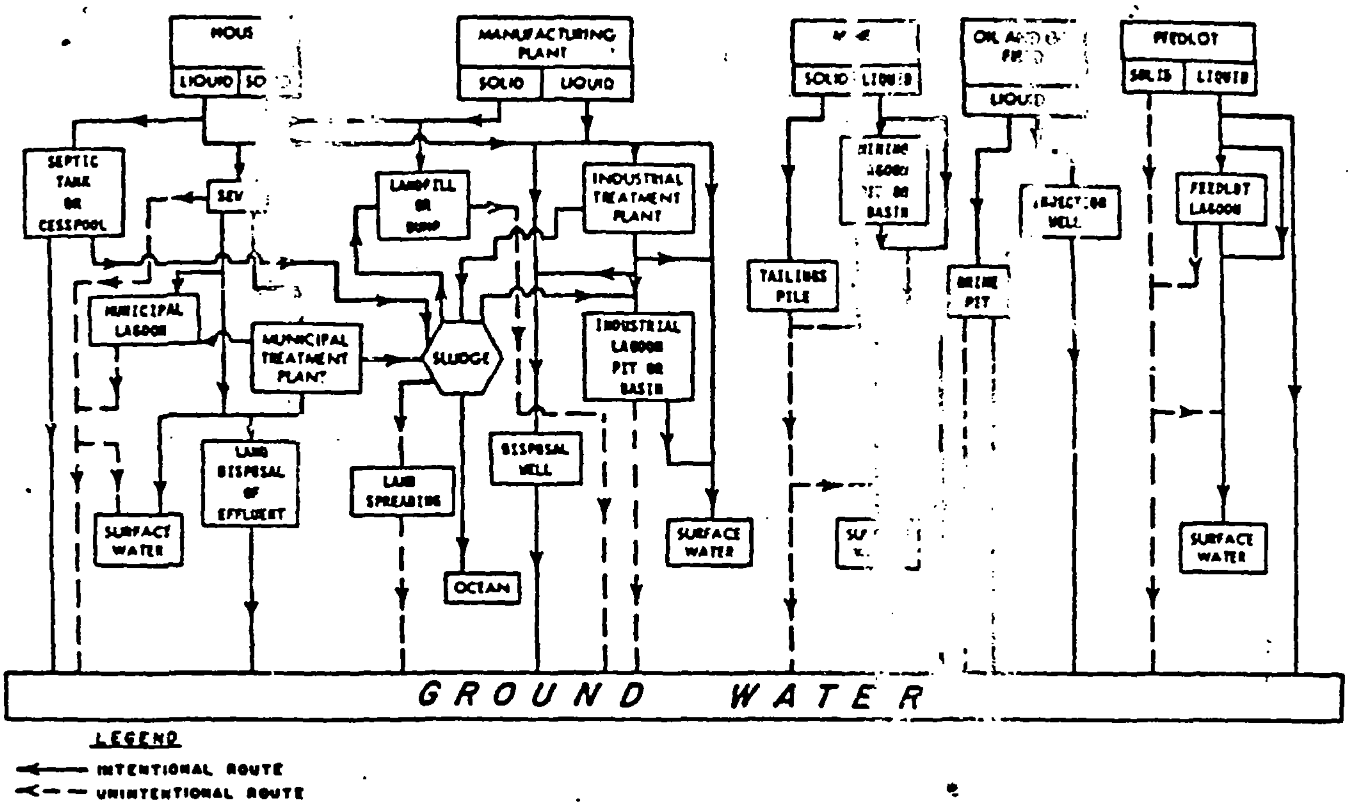
Activity/Source	RES	COM	IND	SP	GOV	STGE	REC	AG	[illegible]
1. Sanitary sewer line exfiltra[illegible]	●	●	●	●	●	●	●		
2. Package treatment plants	●	●	●	●	●		●		
3. Septic tanks/leach fields	●	●	●				●	●	
4. Chemical lawn treatment	●	●	●	●	●	●	●		
5. Domestic chemical waste	●							●	
6. Above ground storage	●	●	●	●	●			●	
7. Subsurface storage	●	●	●	●	●			●	
8. Materials used in process		●	●	●				●	
9. Materials used in maintenance		●	●	●	●		●	●	
10. Loading and transporting of materials		●	●	●	●			●	
11. On-site pretreatment			●						
12. Solid waste dumps			●		●			●	
13. Solid waste landfills			●		●			●	
14. Hazardous waste disposal			●	●	●				
15. Liquid waste lagoons			●		●				
16. Extraction operations			●				●	●	
17. Junkyards		●	●					●	
18. Hospitals	●	●	●	●					
19. Cemeteries	●	●		●				●	
20. Schools	●	●		●	●			●	
21. Surface coal storage			●		●				
22. Surface salt storage					●	●			
23. Subsurface petroleum storage	●	●	●	●	●			●	
24. Wastewater treatment plants			●		●			●	
25. Road salt usage	●	●	●	●	●	●	●	●	
26. Artificial aquifer recharge			●		●		●		
27. Storm sewer exfiltration	●	●	●	●	●	●	●		
28. Petroleum pipelines						●		●	
29. Spills	●	●	●	●	●	●	●	●	
30. Chemical vegetation treatment	●	●	●	●	●	●	●	●	
31. Insect control	●						●	●	

TABLE 2 (continued)

Activity/Source	Land Use Category: RES	COM	IND	SP	GOV	ST[illegible]	R[illegible]	[illegible]	MISC
32. Deposit of material.		•	•	•	•	•	•	•	•
33. Cropping practice								•	
34. Animal feedlots								•	
35. Sludge disposal					•				
36. Septage disposal								•	
37. Stormwater drain[illegible] and basins	•	•	•	•	•	•	•		•
38. Stormwater drainage [illegible]	•	•	•	•	•	•	•		•
39. Erosion/sedimentatio[illegible]	•	•	•	•	•		•	•	•
40. Excavations	•	•	•	•	•	•	•	•	•
41. Flood plains					•		•	•	•
42. Garbage deposits	•	•	•	•	•	•	•	•	•
43. Abandoned wells	•	•	•	•	•		•	•	•

Figure 4

WASTE DISPOSAL PRACTICES AND THE ROUTE OF CONTAMINANTS
FROM SOLID AND LIQUID WASTES



SOURCE: WASTE DISPOSAL EFFECTS ON GROUND WATER; Miller, David W. (Ed), 1980.

1. **Sanitary Sewer Line Exfiltration**

The sanitary sewer lines that connect buildings to a municipal wastewater treatment plant (WWTP) are subjected to disruptive forces such as tree roots, the subsidence of underlying soil, deterioration with age, and other factors that can cause breaks or the heaving of lines and misalignment of joints. The resulting leakage can reach substantial amounts and has been estimated at 5% of the total flow.[1] For the study area, the 5% estimate would mean that 2 - 5.5 million gallons per day (mgd) of sewage may be exfiltrating into surrounding soils and thus has the potential to reach groundwater.

---

1 Waste Disposal Effects on Ground Water; Miller, David W. (Ed), 1980.

The substances from leaking sanitary sewers that can contaminate groundwater are not limited to the pathogenic biological organisms such as bacteria, viruses, and parasites, or the high levels of nitrogen that are normally associated with human wastes. Sanitary sewer lines additionally receive a variety of substances that are poured into the waste-drains of residential, commercial, and industrial establishments. These include cleaners, waxes, detergents, paints and paint thinners, and other households products, as well as oils, greases, solvents, metals, and various exotic chemicals used in research efforts or that result from commercial and industrial processes.

2. Package Treatment Plants

Apartment buildings, mobile home parks, and commercial and industrial sites that are not connected to a municipal WWTP often install a small-scale package treatment plant to process sanitary and other wastes. The sanitary sewer lines leading to these small plants are subjected to the same disruptive forces previously noted for municipal WWTP sewer lines. Moreover, these plants typically include underground tanks designed to hold the wastes during the treatment process. Such tanks may settle and crack, and are vulnerable to corrosion and general deterioration during their 20-40 year design-life. The substances that subsequently leak from the sewer lines and/or the tanks are the same as noted under C.1. The level of treatment achieved by package plants is often inadequate to remove the full range of potential contaminants found in residential, commercial, and industrial wastes.

3. Septic Tanks/Leach Fields

Residential subdivisions located in unsewered areas rely on individual septic tank systems for the treatment and subsurface disposal of wastewater. Groundwater contamination from leaking in-flow lines and the septic tank itself can occur for the same reasons cited under C.1. and C.2. Contamination can also occur in the subsurface leach field due to inadequate waste treatment caused by clogging, high groundwater, highly porous soils, high densities of septic tanks, and by surface ponding accompanied by run-off into nearby domestic wells. Substances of concern include those listed under C.1 and C.2 as well as organic septic tank cleaning compounds which contain such solvents as trichloroethylene, benzene, and dichloromethane.

4. **Chemical Lawn Treatment**

- Residential lawns and gardens, golf courses, commercial and industrial office areas, and agricultural operations all use fertilizers and pesticides (herbicides, fungicides, insecticides, rodenticides) that have the potential to reach groundwater by percolation through lawn and garden soils. Factors increasing the contamination potential include spills, heavy or frequent applications, porous soils, and high groundwater tables. Substances of concern are nitrogen and phosphates from fertilizers, and the 1200-1400 active ingredients used to formulate some 50,000 end-use pesticide products.[2]

5. **Domestic Chemical Waste**

Household wastes are composed of a wide variety of products including hazardous and toxic substances. Paint and paint removers, drain cleaners, oven cleaners, disinfectants, detergents, waxes, bleaches, aerosol sprays, automobile antifreeze and waste oil, driveway coatings and roofing tar, and various pesticides are only a few of the household products commonly used and discarded. Extrapolating information from the City of Tacoma, Washington[3] (population 150,000), to the population of the study area (561,846), suggests that approximately 998 tons of liquid household cleaners, 272 tons of toilet bowl cleaners, and 249 tons of motor oil are used annually within the study area.

Much of the discarded portion of these products is disposed of in municipal landfills, contributing to the landfill's leachate and the resulting potential for groundwater contamination. Other portions of unwanted household products are disposed of in storm sewers and household drains where they may reach groundwater through storm and sanitary sewer line leakage or through malfunctioning septic tank systems. Some products are emptied directly onto the ground, or burned in backyard pits and barrels which causes hazardous substances to become concentrated in the ashes and then leach into the groundwater.

---

2 Protecting the Nation's Groundwater From Contamination: Volume II (Washington, DC: U.S. Congress, Office of Technology Assessment, OTA-O-275, October, 1984).

3 Cited in Ibid.

6. Above-ground Storage

Residential, commercial, agricultural, and industrial areas all commonly use above-ground tanks and barrels to store a large variety of substances. These include heating fuel oil, gasoline, acids, solvents, technical grade chemicals, and processing and treatment products. Groundwater contamination potential is a function of spills, improper handling, tank or barrel ruptures and corrosion, leaking pipe fittings and hoses, and improper disposal practices; in short, any situation that results in a substance being emptied onto the ground.

7. Underground (Subsurface) Storage

While the land use classifications and attendant substances included in C.6. (above) are also found in underground storage tanks, the most numerous tanks are those used for storing petroleum products. Gasoline, kerosene, and diesel fuel are stored by service stations, airports, corporations with car fleets, trucking industries, and others. In the United States, an estimated 1.2 million steel underground tanks are found at service stations alone, and a total of 2.5 million underground tanks are used for storage of petroleum and non-petroleum products nationwide.[4]

Corrosion-caused leaks of gasoline storage tanks are the most frequently cited causes of groundwater contamination from underground storage facilities, with the age of the tank noted as the principal factor. In New York, 86% of the leaks are in tanks more than ten years old,[5] and EPA estimates that 75%, or 900,000 steel tanks, may be leaking within the next five years.[6] Fiberglass tanks, while more corrosion-resistant than steel, are nonetheless subject to corrosion-induced leakage. Additionally, fiberglass tanks are more prone to cracking and the separation of seams caused by careless handling and

---

4 Ibid.

5 New York State Department of Environmental Conservation, 1982; cited in Ibid.

6 <u>Protecting the Nation's Groundwater From Contamination: Volume II</u> (Washington, DC: U.S. Congress, Office of Technology Assessment, OTA-O-276, October, 1984).

incorrect installation, and fiberglass can be weakened by alcohol-blend gasoline.

8. **Materials Used in Process**

The raw materials used during various commercial and industrial processes pose a groundwater contamination potential due to their high concentrations and large quantities. Accidental spills and disposal of unused portions and containers are the most common routes of contamination.

9. **Materials Used in Maintenance**

Degreasing solvents used to clean machinery and work areas have a contamination potential resulting from spills and from being flushed into sanitary or storm sewer lines.

10. **Loading, Transport, and Unloading of Materials**

Groundwater contamination potential from the transfer and transport of materials is a function of leaks, spills, and ruptures. According to an Office of Technology Assessment report,[7] of the 6540 transfer and transport hazardous materials incidents reported to the U.S. Department of Transportation in 1982, 85% involved highway carriers and 13% involved railway transport. The substances include materials such as "paint products, battery fluids, gasoline, corrosive compounds, flammable compounds, various acids, and anhydrous ammonia."[8]

11. **On-site Pretreatment (Industrial)**

See "Liquid Waste Lagoons" (C.15.).

---

7 Protecting the Nation's Groundwater from Contamination: Volume II (Washington D.C.: U.S. Congress, Office of Technology Assessment, OTA-O-276, October, 1984).

8 Ibid.

12. **Solid Waste Dumps**

Dumps are generally unauthorized, unsupervised, and do not discriminate as to the type of wastes deposited. Dumps that leave the wastes uncovered are termed "open" dumps, and many of these experience fires caused by smoldering wastes, spontaneous combustion, or intentional burning to reduce volume. Abandoned automobiles, furniture, containers of discarded agricultural products, wastes from demolition and construction activities, industrial and commercial wastes, and various household wastes are examples of items commonly deposited in dumps. While open, non-discriminatory dumps are now illegal, dumps of this type that were operated in past years but are now inactive continue to pose a significant threat to groundwater quality.

Often located in man-made and naturally occurring depressions, dumps frequently are found in areas that are geologically unsuited due to highly permeable soils, high groundwater, or both. An open dump may be intended to receive only debris from demolition and construction activities and other inert "fill" material; however, the lack of supervision at these sites make them attractive for the deposition of virtually any unwanted material. Dumps are often relatively small in size, causing them to be a low priority item for the over-extended staffs of local and state regulatory agencies.

13. **Solid Waste Landfills** (Sanitary)

Municipal landfills accept wastes from residential, commercial, and industrial sources and are generally of the "sanitary" landfill type wherein the waste materials are covered daily with a layer of soil to reduce the nuisance problems of odor, vermin, insects, and fire. The wastes from any of the three sources may be either in solid, semi-solid, liquid, or containerized gaseous form. While intended to receive only non-hazardous wastes, some portion of the wastes from all sources are likely to be hazardous as well.

Large industries and government installations often operate their own on-site solid waste landfills as a more economical method of disposal than transport to a distant municipal site. Largely self-monitored, economic considerations may result in their being used for the deposition of unauthorized and inappropriate materials. Of equal or greater concern are those landfills used in past decades when regulations were non-existent or unenforced. Often located in low-value areas of the site such as abandoned gravel pits or marshy areas, these older sites have a high potential for contributing to groundwater contamination.

Minimizing groundwater contamination from landfills requires proper siting, design, construction, and operation and maintenance of the facility; considerations that were seldom addressed in older landfills. Percolation of rainwater, the inherent moisture content of the wastes, and intercepted groundwater all contribute to the formation of leachate. Long-abandoned landfills that were sited and operated under less stringent regulations may continue to produce leachate for decades, and their locations may not be known until the pollution reaches crisis levels.

14. Hazardous Waste Disposal

Hazardous wastes are defined as "any solid waste that may cause or significantly contribute to serious illness or death, or that pose a substantial threat to human health or the environment when improperly managed."[9] The use of the term "solid waste" is misleading since liquid wastes can also fall under this definition. In general, if a substance is flammable, corrosive, explosive, or toxic, it is hazardous. U.S.E.P.A.'s Resource Conservation and Recovery Act (RCRA) has provisions for proper site selection and containment measures for newly permitted hazardous waste disposal sites. Locating, monitoring, and evaluating an unknown number of old and abandoned sites, however, will remain a problem well into the future.

Hazardous waste landfills placed into operation after January 1983 are required to have a containment liner and a leachate collection and removal system, although exemptions are possible under certain conditions. Liners may be natural materials with low permeability such as clay, or man-made liners, usually plastic. Both types of liners have been known to deteriorate and leak due to contact with various chemicals, and the long-term effectiveness of either type is not known. Moreover, landfills that received hazardous wastes prior to the effective date of the Resource Conservation and Recovery Act (January 26, 1983) are exempt from the requirements.

---

9 Groundwater Protection, A Water Quality Management Report; U.S.E.P.A., Water Planning Division, November, 1980.

15. Liquid Waste Lagoons

Municipalities [illegible] pits, ponds, and lagoons for storing or treating WWTP sewage and drinking water treatment residuals. Some surface impoundments are designed to concentrate the stored materials by evaporation, while others use seepage into the underlying soil as a method of de-watering the materials. Municipal sewage contains pathogenic organisms and a wide variety of both hazardous and non-hazardous wastes that have been placed into the sanitary sewer lines by residential, commercial, and industrial users.

Industrial surface impoundments are used to retain, treat, and/or dispose of liquid wastes, both hazardous and non-hazardous. Disposal may be either by periodic or continuous discharge to a stream, or by evaporation and seepage. There are 26 industrial lagoons within the study area, and most are located over the principal aquifer where soils are highly permeable. Moreover, one-half of the lagoons are less than one mile from a public water supply well, raising the distinct possibility of contaminants being drawn in by the well's zone of influence.

Some local governments require certain industries to pretreat wastes prior to discharge to the sanitary sewer system. Industrial pretreatment plans, adopted by the local government and approved by Ohio EPA, set forth the allowable limits on various constituents of the industrial wastewaters.

16. Extraction Operations

The major extraction operations in the Miami Valley Region are sand and gravel pits and limestone quarries, with the former being the principal type of operation in the study area. Gravel pits are most frequently found near the larger-order streams and the extraction actually involves removal of the materials that make up the water-bearing formations referred to as aquifers. Water-filled gravel pits, therefore, represent "windows" into the upper aquifer layer and are vulnerable areas since they provide contaminants direct access to the groundwater supply.

Active gravel pits present the potential for contamination fr machinery-related petroleum products stored and used at the site, from airborne particulate matter settling onto the exposed groundwater, and from sedimentation stirred-up during dredging. Abandoned pits are too often used as dumps, landfills, and for the deposit of salt-laden snow from highway clearing operations.

17. Junkyards (Automotive Wrecking Yards)

Products commonly associated with motor vehicles that have the potential to contaminate groundwater include gasoline, battery acid and lead, oil and grease, antifreeze, and brake fluid. Siting factors such as permeable soils and high water tables increase the contamination potential as do the number of vehicles stored and the number of years the wrecking yard has been in operation.

18. Hospitals

Hospital wastes introduced into sanitary sewer lines or that find their way to municipal landfills may contain pathogens associated with infections and diseases, as well as heavy metals, radionuclides, and other toxic substances used for diagnosis, treatment, and research. Additionally, hospitals located in unsewered areas rely upon on-site package treatment plants which, because of the high loading rate, may not provide adequate treatment of the wastes (See "Package Treatment Plants", C.2.).

19. Cemeteries

Fluids from decomposing bodies have the potential to contaminate groundwater when cemeteries are located in areas with permeable soils or a high water table. The Rose Hill and Riverside Cemeteries in Troy, for example, are both less than 1000 feet from the Great Miami River and are located in Eldean soils that have a sand and gravel substratum with a permeability greater than twenty inches per hour.[10] The House of Jacob Cemetery in northeast Dayton is similarly close to the river and is located in Celina soils which may have a seasonal water table as shallow as 1 1/2 feet.[11]

---

10 Soil Survey of Miami County, Ohio; U.S. Department of Agriculture, January, 1978.

11 Soil Survey of Montgomery County, Ohio; U.S. Department of Agriculture, June, 1976.

20. Schools

Outlying schools may use package treatment plants for sewage treatment and disposal. These plants can become overloaded from heavy usage, resulting in inadequate treatment. Materials used in school laboratories possess the potential to contaminate groundwater when poured into drains or when discarded in landfills.

21. Surface Coal Storage

Coal stockpiles are primarily maintained by electric utility companies and industries. Rainwater percolating downward through coal piles can pick up soluble substances and carry them into the groundwater. About 1 1/2 dozen substances, ranging from arsenic to zinc, are present in coal piles, and oxidation reactions within the stockpile produce sulfuric acid. In addition to its own contamination potential, the acid can also dissolve other contaminants found within the coal pile and thereby increase the number of substances that find their way into the groundwater.

22. Surface Salt Storage

Many tons of salt are stored on the land surface for use in street and highway snow and ice control. The amount of tonnage stored is related to the miles of roadway within a jurisdiction and the severity of the weather. Salt is highly soluble and is rapidly dissolved by rainfall and snowmelt. Moreover, the contaminant of concern, chloride, is highly mobile, moves freely with the percolating water, and is not removed by filtration through the soil overlying the groundwater. Salt storage has been cited as "perhaps the prime example of ground water pollution caused by stockpiles . . ."[12]

23. Subsurface Petroleum Storage

See "Underground (Subsurface) Storage" (C.7.).

---

12 A Manual of Laws, Regulations, and Institutions for Control of Ground Water Pollution; U.S.E.P.A., June, 1976.

24. Wastewater Treatment Plants (WWTPs)

The groundwater contamination potential from WWTP operations centers around land application of the semi-solid byproducts (sludge) of the treatment process. Sludge constituents of particular concern are nitrogen, phosphorus, and the heavy metals contributed to wastewater by industrial processes. Groundwater contamination can occur when these substances are leached out by rainfall after the sludge is applied to the land. The municipal WWTPs in the study area produced more than 46 tons of dry weight sludge per day during September and October of 1983.[13] Other sources of contamination include leakage of chemicals such as chlorine, and spills.

25. Road Salt Usage

Chloride levels in drinking water that exceed 250 parts per million (ppm) are considered to constitute contamination; chloride levels from highway de-icing salts have been found to range from 1,130 to 25,000 ppm in snowmelt road runoff.[14] Because chloride is highly soluble and remains in solution despite percolation through the soil, groundwater contamination can occur when chloride-laden roadway snowmelt reaches adjacent soils, or by exfiltrating through breaks and joints in a storm sewer line. Besides contamination from high chloride levels, de-icing salts can also result in excessive concentrations of cyanide that are produced when sodium ferrocyanide, added to minimize caking of the salts, is exposed to sunlight.[15] The amount of salt used varies with the weather conditions during each winter season. Within the study area, for example, more than forty tons were used during the 1981-82 season, while usage fell to sixteen tons for 1982-83.[16]

---

13 Source: OEPA/SWDO files, Monthly Operating Reports.

14 Cited in Protecting the Nation's Groundwater From Contamination: Volume II (Washington, DC: U.S. Congress, Office of Technology Assessment, OTA-O-276, October, 1984).

15 Ibid.

16 Factors Potentially Impacting Groundwater Quality of the Great Miami Buried Valley Aquifer in the Miami Valley Region: MVRPC, December 31, 1983.

26. **Artificial Aquifer Recharge Areas**

Artificial recharge areas are highly sensitive to contamination because they are deliberately located, constructed, and maintained to effect a direct connection with the buried valley aquifer. Those recharge areas utilizing river water for recharge are at a particularly high risk due to the greater variety and higher concentrations of contaminants found in surface waters as compared to rainwater. Recharge areas that are dependent upon precipitation may be less susceptible to contamination, but are at some risk nonetheless. Airborne contaminants reach the land surface through dry deposition fallout as well as being washed from the atmosphere during periods of rain and snowfall. Contaminants from automobile emissions and industrial particulate matter include lead, chromium, and other heavy metals along with sulfur and nitrogen compounds. A literature review concerning the relationship between acid rain and groundwater, conducted for the National Center for Ground Water Research, concluded that "acid rain may react with soils and surface waters in such a way as to increase the leaching of metals and nutrients."[17]

27. **Storm Sewer Line Exfiltration**

Storm sewers, like sanitary sewers, are subjected to disruptive forces that may result in leakage (See "Sanitary Sewer Line Exfiltration", C.1.). The contaminants of concern are listed under "Stormwater Drainageways and Retention Basins" (C.25.).

28. Transport Pipelines

Underground pipelines are used to transport several products, the most common being petroleum products, natural gas and anhydrous ammonia. Transport pipelines are subject to internal and external corrosion, and can be ruptured by tree root-caused heaving or by loss of foundation support, and many thousands of barrels of materials can be lost before the leakage is detected and located. Pipelines underlie all land uses and their relatively shallow depth makes them vulnerable to breakage during any type of excavation operation.

---

17 Cited in <u>Groundwater Contamination in the United States</u>; Pye, Veronica I. et. al., 1983.

29. Spills

Accidental spills are an inherent hazard wherever materials are handled. Of particular concern are spills that result from highway and railway transport accidents since these may involve large quantities of material. Adsorption or absorption by the unsaturated soil layer may contain small spills, while larger quantities have the potential to continue percolating downward to reach groundwater.

30. Chemical Vegetation Treatment

State and local governments commonly use weed control chemicals along roadways and median strips. Concerns are the same as those expressed under "Chemical Lawn Treatment" (C.4.).

31. Insect Control

Insecticides "fogged" into the air for generalized insect control, sprayed onto trees and shrubs, or applied to standing water and marshy areas are potential *groundwater contamination contributing practices.* Heavy or frequent applications and spills are of concern as is disposal of the unused portions and containers. (See also C.4.).

32. Deposit of Materials

The illegal dumping of wastes poses a threat to groundwater since neither the type of wastes nor the manner and place of disposal can be supervised.

33. Cropping Practices

See "Chemical Lawn Treatment" (C.4.).

34. Animal Feedlots

The high densities of animals that characterize feedlot operations create the potential for groundwater contamination from the large volume of manure produced. It is estimated that each 1000 head of cattle, for example, produce 500 tons of manure during the 4-5 months they are confined to the feedlot.[18] Nitrate is the principal contaminant of concern and can reach groundwater easily since it is highly soluble in water and is poorly attenuated by soil. Bacteria, viruses, phosphates, and food additives (e.g., hormones and antibiotics) which the manure leachate may contain are also of concern.

35. Sludge Disposal

Pre-treatment of drinking water and the treatment of wastewater by municipal and industrial treatment plants results in a residue of semi-solid sludge which must then be disposed of, usually by land application. Groundwater contamination can result from rainfall leaching out the sludge constituents after land application. Constituents of concern include biological organisms, exotic chemicals, toxic compounds, and heavy metals. While careful selection of application sites and proper application rates may reduce the risk of contamination, the potential for migration of numerous sludge constituents is not well known.

36. Septage Disposal

On-site wastewater treatment and disposal systems used by residences and commercial establishments also produce residual semi-solids (septage) that are disposed of by land application. Contamination concerns are similar to those mentioned in C.23. above.

37. Stormwater Drainageways and Retention Basins

Both roadside stormwater drainage ditches and depressions designed to retain stormwater runoff for flood control have the potential to contribute to groundwater contamination. Stormwater and snowmelt runoff contains chloride, cyanide, heavy metals such as lead and chromium, oil and grease residues, polychlorinated biphenyls (PCBs), pesticides, and fertilizers. The levels of these and other pollutants may equal or exceed those found in untreated wastewater.[19] The

---

18 Groundwater Contamination in the United States; Pye, Veronica I. et. al., 1983.

19 Water Pollution Aspects of Street Surface Contaminants; U.S.E.P.A., 1972.

potential for these contaminants to reach groundwater is increased when frequent or prolonged precipitation periods cause a rise in groundwater levels.

38. Stormwater Drainage Pits (Wells)

Most municipal stormwater drainage systems terminate by discharging into a nearby stream where the contaminants may reach groundwater by well pumping-induced infiltration through the streambed. A more direct contamination route is provided by those drainage systems that terminate in deep pits dug into sand and gravel deposits, allowing the stormwater to mix freely with the groundwater.

39. Erosion/Sedimentation

Agriculture, construction, and extraction are the activities most likely to involve the stripping of vegetation and the resulting increase in erosion/sedimentation. Pollutants that adhere to soil particles or are otherwise carried along in the erosion process become part of the sedimentation that collects in depressions. This may create local "pools" of sediment that have high concentrations of pollutants which are then leached into the groundwater by subsequent rainfalls. This is a repetitive process wherein each rainfall both leaches the previously accumulated pollutants and replenishes the pollutants so leached.

40. Excavations

Excavations, often dug during construction of buildings and to make storm, sanitary sewer line or other repairs possible, create spaces where innumerable substances can be thrown or dumped. At best, these may be deposited into the soil; at worst, they may enter groundwater directly if the excavation intersects the water table.

41. Flood Plains

The potential for groundwater contamination is high in floodplains due to their rapidly permeable sand and gravel substrata and the shallow depth to groundwater. Contamination sources such as landfills, septic tank systems, and pesticide and fertilizer application are examples of uses and practices that substantially increase the potential for groundwater contamination to occur.

42. **Garbage Deposits**

See "Deposit of Materials" (C.36.).

43. **Abandoned Wells**

Abandoned wells may be left unplugged or have their casings removed, and the casings may corrode with time, situations which can provide direct access for surface contaminants to reach groundwater. Dug and walled wells, because of their larger diameters, may be used as a disposal pit for all types of solid and liquid wastes.

D. The Regulatory Framework

Regulation and control of the many activities and sources discussed above is often a complex matter. A detailed analysis of the legal and organizational framework within which this occurs is beyond the scope of this study. It is helpful, however, to review, even in very general terms, the level or levels of government where responsibility lies for the various impact factors. Table 3 is intended to present such a review quickly and concisely.

E. Land Use Categories and Selected Activities/Sources for Local Government Regulations Analysis

The forty-plus potential pollutant activities/sources identified in this study have been related to nine general land use categories as shown in Table 4. Many of these are, or may be, a function of several land use categories. In order to proceed with the research on local regulations using land use categories as a basis, certain activities/sources within each land use were selected for examination as a function of a particular category or categories. The results of this selection process are presented in Table 4 below. The rationale behind this is that within subareas of communities characterized by a particular land use, certain potential pollutant activities/sources are likely to be of special concern and worthy of attention. This is not meant to imply that others are unimportant. However, it may provide a starting point for communities as they examine where efforts can be best focused in order to contribute to groundwater protection based upon their local land use patterns, while serving as a manageable research model as well.

TABLE 3

POTENTIAL POLLUTANT ACTIVITIES/SOURCES
BY
GOVERNMENTAL LEVEL OF RESPONSIBILITY

Activity/Source	Governmental Level of Responsbility					
	Municipal	Twnshp.	County	Special District	State	Fec
1. Sanitary sewer line exfiltration	X		X			
2. Package treatment plants	X		X	X	X	
3. Septic tanks	X			X		
4. Pesticides/Fertilizers/ Chemical lawn treatment					X	
5. Domestic chemical waste	X					
6. Above ground storage	X	X	X		X	
7. Underground subsurface storage	X	X	X		X	
8. Materials used in process	X	X	X			
9. Materials used in maintenance	X	X	X			
10. Loading, transport, unloading of materials	X	X	X		X	
11. On-site pretreatment	X		X		X	
12. Solid waste dumps	X		X		X	
13. Solid waste landfills	X		X		X	
14. Hazardous waste disposal	X				X	
15. Liquid waste lagoons	X	X	X		X	
16. Extraction operations	X	X	X			
17. Junkyards	X	X	X			
18. Hospitals (wastes)	X	X		X	X	
19. Cemeteries		X		X		

TABLE 3 (Continued)

Activity/Source	Governmental Level of Responsbility: Municipal	Twnshp.	County	Special District	State	Feder
Schools (wastes)	X	X		X	X	
Surface coal storage	X	X			X	
Surface salt storage	X	X	X		X	
Wastewater treatment plants	X		X	X	X	
Road salt usage	X	X	X		X	
Artificial aquifer recharge	X		X			
Storm sewer line exfiltration	X		X			
Petroleum pipe lines					X	X (C
Other pipe lines (anhydrous ammonia)					X	X (D
Spills	X	X	X		X	
Chemical vegetation treatment	X	X	X		X	
Insect control-materials used	X	X	X		X	
Deposit of materials	X		X			
Cropping practices				X	X	X
Animal feedlots	X			X	X	
Sludge disposal				X	X	
Septage disposal				X	X	
Stormwater drainageways & basins	X		X			
Stormwater drainage wells	X		X			
Erosion/Sedimentation	X		X			
Excavations	X	X	X			
Flood plains	X	X	X	X	X	
Garbage deposits	X	X	X	X	X	
Abandoned wells	X			X		

TABLE 4

LAND USE CATEGORIES AND SELECTED POTENTIAL POLLUTANT ACTIVITIES/SOURCES

LAND USE CATEGORY	POTENTIAL POLLUTANT ACTIVITY/SOURCE
I. Residential	A. Sanitary Sewer Line Exfiltration B. Package Treatment Plants C. Septic Tanks D. Chemical Lawn Treatment E. Domestic Chemical Waste
II. Commercial/Research/ Office	A. Above ground storage B. Subsurface storage C. Sanitary Sewer Line Exfiltration D. Package Treatment Plants E. Septic Tanks
III. Industrial	A. Above Ground Storage B. Subsurface Storage C. Materials Used in Process D. Materials Used in Maintenance E. Loading, Transportation, Unloading of Materials F. On-site Pretreatment G. Solid Waste Dumps H. Solid Waste Landfills I. Hazardous Waste Disposal J. Liquid Waste Lagoons K. Other Waste Disposal L. Extraction Operations M. Junkyards
IV. Semi-Public	A. Hospitals B. Cemeteries C. Schools
V. Governmental	A. Surface Coal Storage B. Surface Salt Storage C. Other Surface Stored Materials D. Subsurface Petroleum Products Storage E. Subsurface Other Materials Storage F. WWTP's G. Road Salt Usage H. Artificial Aquifer Recharge Areas I. Solid Waste Dumps

TABLE 4 (Continued)

LAND USE CATEGORY	POTENTIAL POLLUTANT ACTIVITY/SOURCE
V. Governmental (continued)	J. Solid Waste Landfills K. Hazardous Waste Disposal L. Liquid Waste Lagoons M. Other Waste Disposal
VI. Streets and Easements	A. Sanitary Sewer Line Exfiltration B. Storm Sewer Line Exfiltration C. Petroleum Pipe Lines D. Other Pipe Lines E. Spills
VII. Recreational	A. Chemical Vegetation Treatment B. Insect Control C. Deposit of Materials D. Other
VIII. Agricultural	A. Cropping Practices B. Animal Feedlots C. Sludge Disposal D. Septage Disposal
IX. Miscellaneous Uses/Activities	A. Stormwater Drainageways and Basins B. Stormwater Drainage Wells C. Erosion/Sedimentation D. Excavations E. Flood Plains F. Garbage Deposits G. Abandoned Wells H. Other

APPENDIX 6

PROPOSED CONTAMINATION SITE

CLEAN UP PROCEDURES

PROPOSED PLAN FOR DETAILED CHARACTERIZATION OF HAZARDOUS CHEMICAL POLLUTANTS IN DRINKING WATER AND THE SOURCES OF THESE WHICH IMPACT ON THE AQUIFER SUPPLYING THE CITY OF BEAVERCREEK, OHIO AND SURROUNDING AREAS

Prepared By:

BRENT E. HUNTSMAN and THOMAS O. TIERNAN

BREHM LABORATORY
WRIGHT STATE UNIVERSITY,
DAYTON, OHIO 45435

Submitted To:

CITY OF BEAVERCREEK
BEAVERCREEK, OHIO

FEBRUARY 28, 1986

I. INTRODUCTION

On December 23, 1985, Mr. Marc Marderosian, Vice-Mayor of the City of Beavercreek, Ohio and other Beavercreek officials met with the Dean of Graduate Studies and Vice Provost for Research of Wright State University, Dr. Donald Thomas, and with the Director of WSU's Brehm Laboratory, Dr. Thomas O. Tiernan, and with the Brehm Laboratory's Hydrogeological expert, Mr. Brent E. Huntsman, to discuss water pollution problems currently affecting the City of Beavercreek. At this meeting, Beavercreek officials reviewed the actions which had been taken up to that time by the City, by the Greene County Health Department, by the Ohio Environmental Protection Agency (OEPA), and by various citizens groups and individual citizens in connection with identification of hazardous chemical pollutants in residential well water in certain areas of Beavercreek. The Brehm Laboratory scientists then discussed with the Beavercreek officials the need for the Brehm Laboratory to review the specific data and information bearing on this problem which had been obtained thus far. It was agreed that all available data obtained from chemical analyses of Beavercreek residential wells, information currently being compiled on possible industrial sources, reports from OEPA and any other related information would be provided to the Brehm Laboratory for review and assessment. Following this initial overview by the Brehm Laboratory, it was planned to convene another meeting which would include not only WSU and Beavercreek representatives, but also appropriate persons from the OEPA, the Greene County Health Department, the Clean Water Task Force of

Beavercreek, and any other organizations involved in this problem. After the Brehm Laboratory had received some of the information requested and reviewed this, a second such meeting was scheduled for Jan. 21, 1986.

The participants in the January 21, 1986 meeting included representatives from the City of Beavercreek, WSU, OEPA, Greene County Health Department, U.S. Geological Survey, and Congressman DeWine's office. OEPA representatives gave a brief review of their work and findings in relation to the Beavercreek problem up to that time. Representatives from the U.S. Geological Survey briefly discussed a proposal which they had recently presented to the City of Beavercreek for a long-term water quality monitoring program, and copies of this were distributed. The Greene County Health Department briefly discussed chemical analysis results obtained on well water samples and the actions taken thus far with respect to these. Congressman DeWine's representative discussed Federal actions taken to provide funding for connection of some affected Beavercreek residences to the County water system. Possible future involvement of the U.S. EPA was also discussed by OEPA and the group. Finally, the Brehm Laboratory presented a detailed discussion of the approach which should be taken in assessing a water pollution situation such as that encountered in Beavercreek, outlining the specific actions to be taken and the recommended time sequence of these.

As the final outcome of the January 21, 1986 meeting just discussed, it was agreed that the Brehm Laboratory of WSU would develop a proposed plan of action to address the Beavercreek water pollution problem. It was intended that this plan would address various possible alternative approaches, and that the program proposed would involve all of the organizations represented at the meeting as participants in the R & D effort. It was also intended that this plan provide some indication of the costs of the proposed approach. It was agreed that the plan developed would be initially submitted to the City of Beavercreek for review, and ultimately would be provided to all of the proposed participant organizations for review and comment.

Presented herein is the proposed plan of action to address the Beavercreek water pollution problem which has been developed by the Brehm Laboratory. This begins with a discussion of the status of existing information and the significance of such data, proposes a set of near-term studies to confirm the nature of the pollutants, describes a more comprehensive assessment program which would be required to reliably define the sources and distribution of pollutants, discusses remedial actions to correct the problem, and finally concludes with a recommended long-term monitoring program to ensure continuing quality of the aquifer in this area.

II. REVIEW OF EXISTING INFORMATION

A. Chemical Data to Characterize the Problem

Brehm Laboratory personnel have reviewed all of the water quality analysis data obtained from the City of Beavercreek which pertains to ground water contamination within the City and Beavercreek Township. These water samples were apparently obtained by various sampling procedures and different portions of the total set were analyzed by three different laboratories, Howard Laboratories, PEI Environmental and The Ohio Department of Health. With the exception of several biological and/or inorganic parameters specified in some early sampling episodes, the focus of the ground water monitoring program has been restricted entirely to the measurement of the so-called volatile organic compounds (VOC).

The results of the VOC analyses for collected ground water samples as of February 3, 1986 are attached to this report as Appendix A. Upon review of these results, one immediately notices that the data are highly variable. Approximately fifteen discrete volatile organic compounds have been identified in the ground water samples using gas chromatography/mass spectrometry (GC-MS) analytical techniques. Although several of these compounds have been identified in wells throughout the Township, no single compound is common to all sampling locations. This implies that the sources and types of contamination are currently localized and probably unrelated. In addition, due to the lack of standardized sampling and analyses procedures, the occurrence of some of the compounds may be the result of sample contamination in the field or laboratory, or an artifact of the analytical technique employed. This will be discussed in greater detail below.

As illustrated in Figure 1, the concentrations of 1,1,1-trichloroethane in water samples from the sampled wells in which this compound was detected vary by four orders of magnitude. Of the fifteen sampled locations at which this compound was

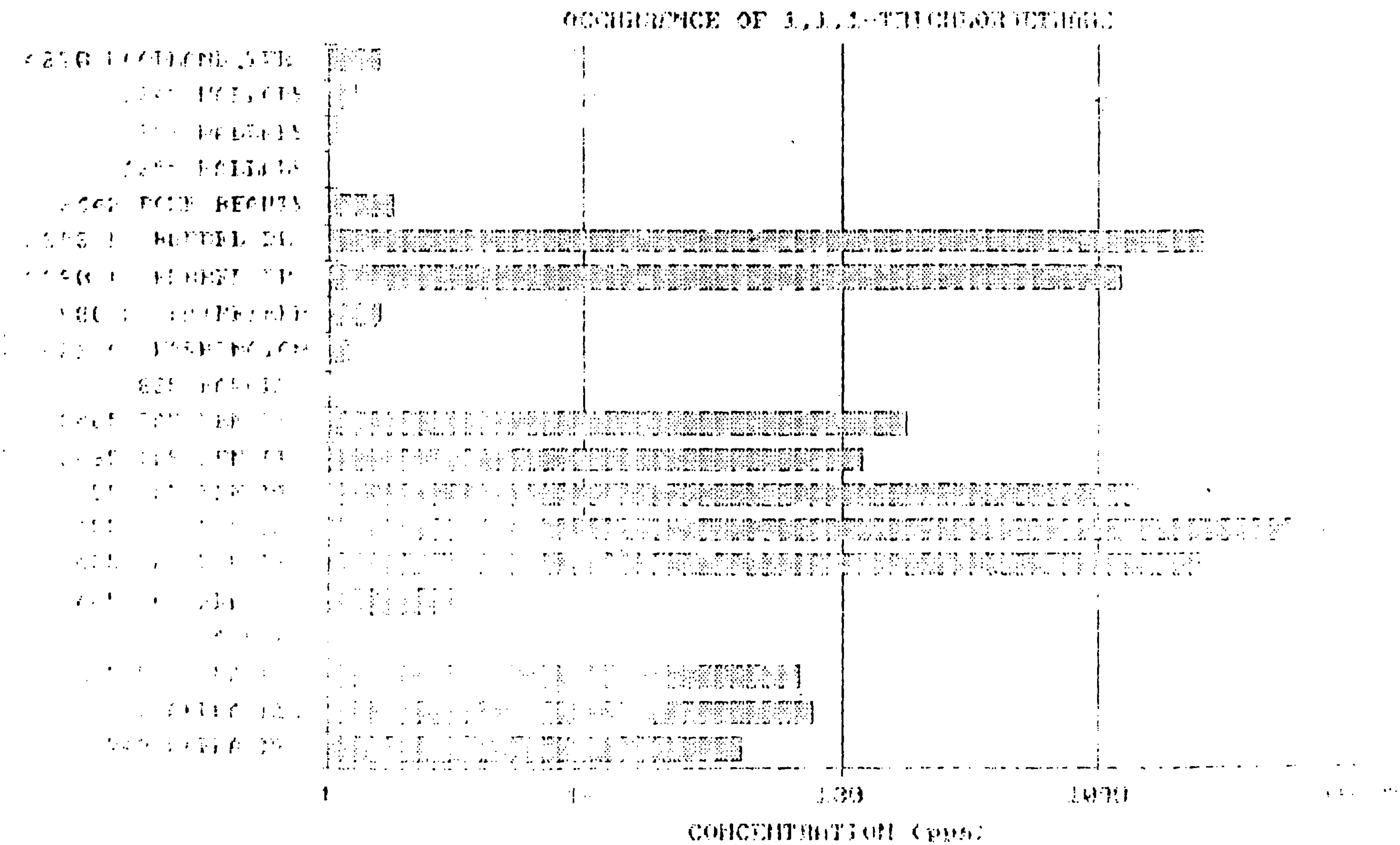


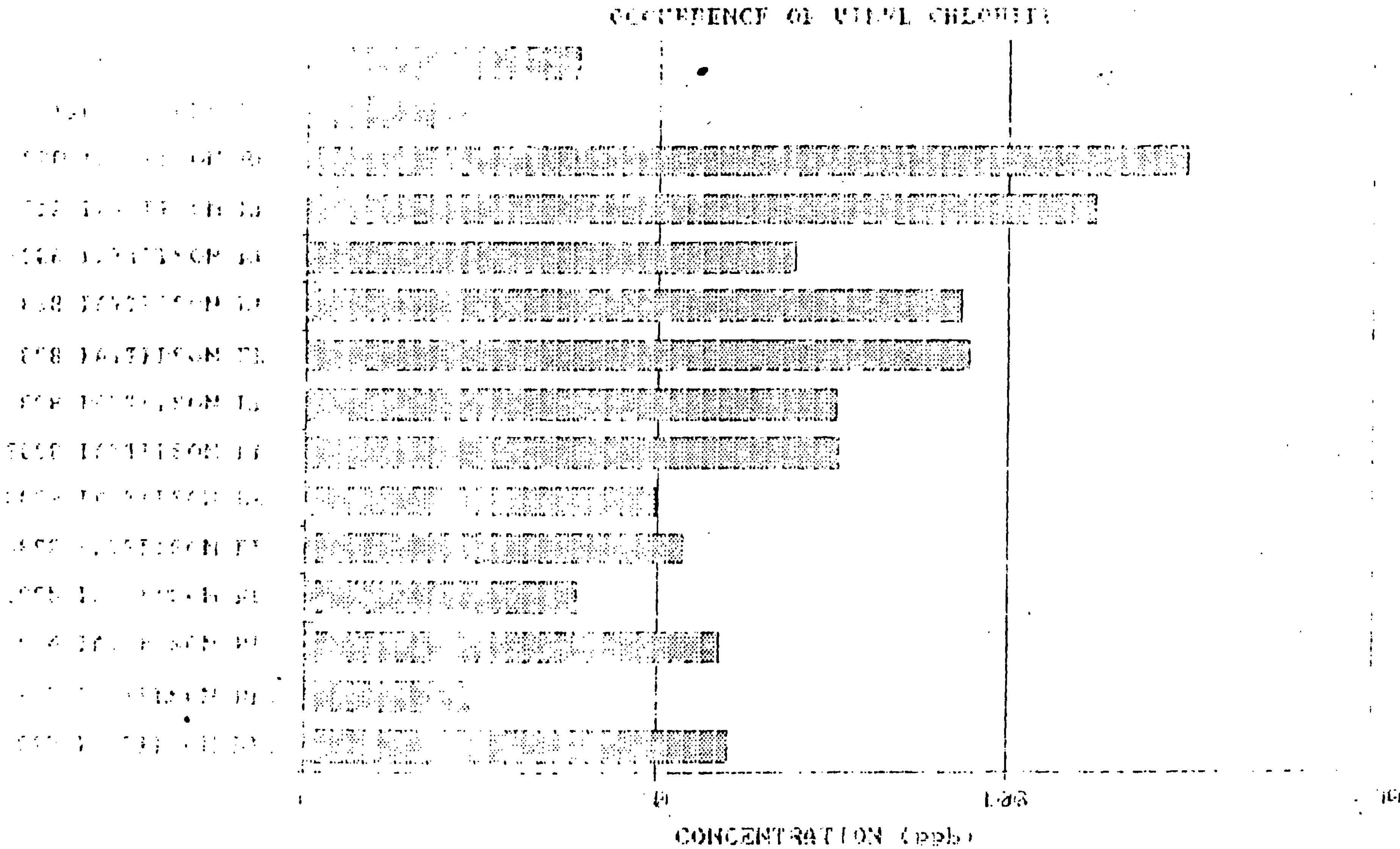
Figure 1

identified, two-thirds of the reported concentration values were below 4 parts per billion (ppb). Because of problems inherent in the analytical technique used to determine VOC concentrations, the 4 ppb value may be at or below the level at which reproducible results can be obtained on actual ground water samples. However, since none of the laboratories identifying 1,1,1-trichloroethane in these samples apparently had available and analyzed along with the actual samples some additional water samples containing known quantities of this compound (field spike), or a duplicate sample of water collected at the same location at the same time (field duplicate), or a sample known to be free of 1,1,1-trichloroethane which was collected in the field using the same procedures as those used in acquiring the ground water samples (field blank), the lower limit of quantification for these analyses cannot be determined. And indeed, such detection limits were not specified with most of the reported analytical data. In an environmental assessment program of this type, it is essential that Quality Assurance and Quality control (QA/QC) analyses of the type just described be analyzed along with the actual field samples in order to ensure the credibility of the analytical data. No QA/QC analytical data of this type was included with the analytical data provided to the Brehm Laboratory for review, and it is presumed, therefore, that the laboratories did not utilize an appropriate QA/QC program.

One final observation should be made concerning Figure 1. Analyses of the replicate samples from 745 Alpha Road and 3455 and 3465 Dayton-Xenia Road appeared to confirm the presence of

1,1,1-trichloroethane at these sites in significant concentrations. Since no replicate samples have been collected and analyzed at the twelve other locations at which this compound was reported the presence of 1,1,1-trichloroethane in the ground water at these sites cannot actually be confirmed and the data must be regarded as equivocal. In general, as mentioned above, the Quality Assurance data provided by all of the laboratories which have accomplished water analyses in connection with this problem are insufficient to permit realistic assessment of the reliability of these data.

As a further example of the variability of the data summarized in Appendix A, vinyl chloride concentrations in the Beavercreek area, as determined from analyses of the ground water samples, are plotted in Figure 2. Several different samplings of the well at 3898 East Patterson Road and subsequent analyses by two separate laboratories confirmed the presence of this compound at about 33 ppb. However, a third and a fourth sampling, followed by analysis of water from this well for volatile organics, indicated vinyl chloride concentrations of 78 and 74 ppb, respectively. This may indicate that between the first two and the last two monitoring episodes changes occurred in the sampling protocol or in the analytical methodology used for these determinations. Unless standardized sampling and analysis procedures are employed throughout such a monitoring program, the results obtained from various sampling episodes cannot be correlated. Of course, it is also possible that the variability observed here reflects changes in the actual content of the



Figur

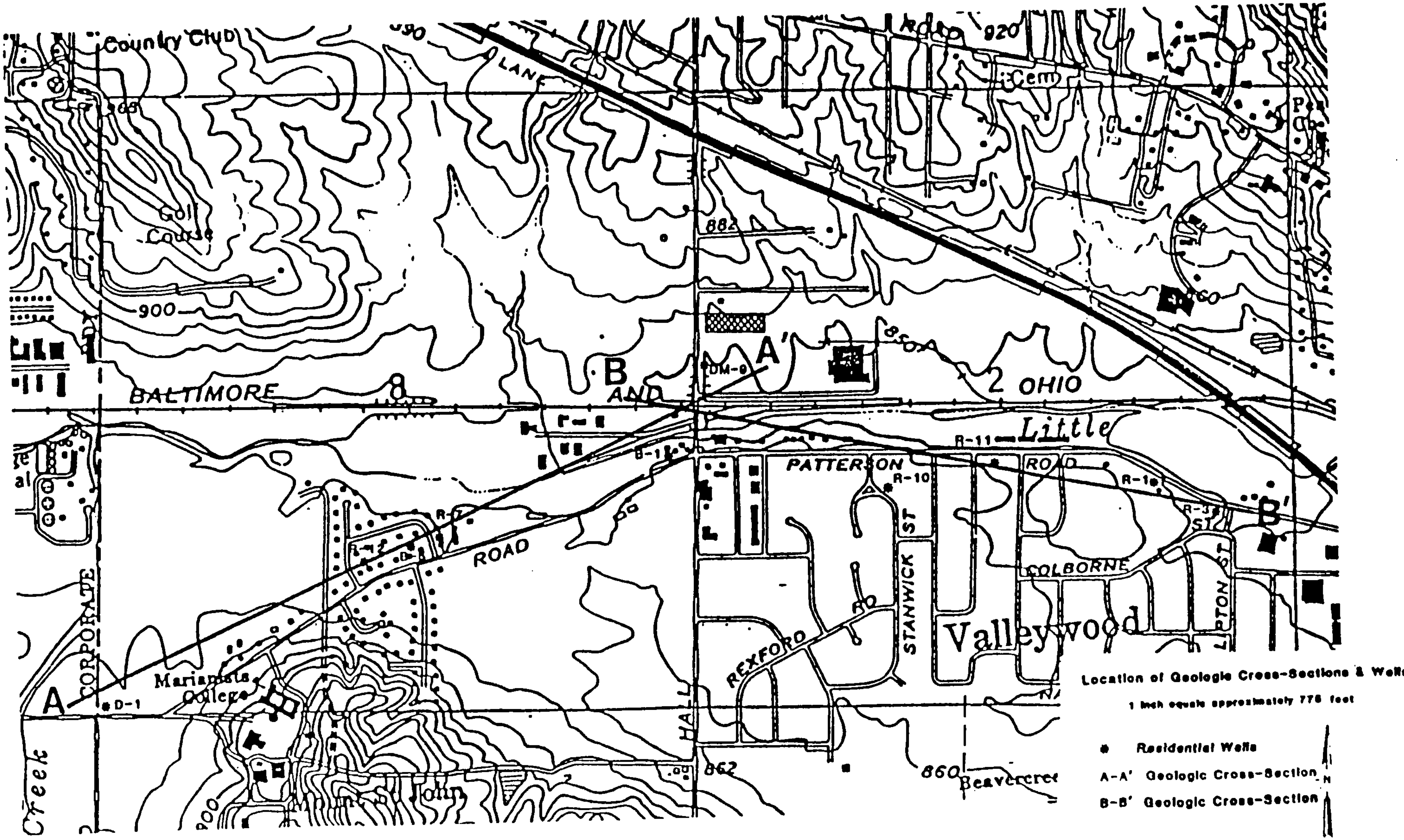
measured pollutants in this well as a function of time. This could only be confirmed through additional monitoring.

After reviewing all of the ground water quality information and recognizing the limitations of the data, only three areas of ground water contamination can be said to be reasonably discernible, these being East Patterson Road near Grange Hall Road, Dayton-Xenia Road in the Shady Brook plat and in Alpha, adjacent to Phil Hubbel Ct. Data obtained for other areas where volatile organic compounds have been reported are inadequate because insufficient numbers of samples have been collected and analyzed over an appropriate time interval to confirm the actual presence of contamination. Also, as already mentioned, limitations imposed by the sampling and analysis techniques utilized in all these instances may have produced erroneous results at these locations.

B. Available Physical Data to Characterize the Problem

Specific information concerning the possible location of potential contamination sources in the Beavercreek area are currently being prepared by the Beavercreek Clean Water Task Force (BCWTF). This information was not available at the time when Brehm Laboratory personnel reviewed the water quality data from well water samples which was provided by the City of Beavercreek. Specific identification of possible sources will require the assembly of historical information on sites known to have used, handled or released chemicals which are currently being detected in the ground water. In addition to the historical data, information concerning current up-gradient industrial sites, and locations of pipelines used for waste or product transfer, as well as information on any hazardous waste treatment, storage or disposal permits issued to companies in this area should be obtained.

Additional physical data which are needed with respect to the contaminated areas identified include detailed hydrologic and geologic summaries for areas up-gradient, on-site and down-gradient of each location. Existing information, such as well logs and published reports by state and federal agencies are useful in delineating the general hydrogeologic conditions at a site. For example, Brehm Laboratory personnel collected and interpreted some of the available information relevant to the geologic setting near the intersection of Patterson and Grange Hall Roads. As illustrated in Figure 3, traverses A-A' and B-B' were selected for constructing geologic cross-sections. The lithologic information for the ten wells depicted on this drawing was correlated and is presented in Figures 4 and 5. Although these cross-sections appear to be complete in terms of their description of the site, the reader is cautioned that the information used to create the cross-sections was highly fragmentary in terms of detail, and Figures 4 and 5 represent only a **conceptual** interpretation of the prevailing hydrogeologic conditions. Only through the design and implementation of a detailed soil boring and ground water monitoring program can the actual hydrogeologic parameters which govern the movement of contaminants in an aquifer such as this be defined. Such data is



Country Club
Golf Course
900
BALTIMORE
AND
2 OHIO
Little
PATTERSON
ROAD
ROAD
COLBORNE
STANWICK ST
REXFORD RD
Valleywood
CORPORATE
HALL
Marianists College
A
A'
B
B'
D-1
R-11
R-10
R-1
882
862
860
Cem
Location of Geologic Cross-Sections & Wells
1 inch equals approximately 775 feet
Residential Wells
A-A' Geologic Cross-Section
B-B' Geologic Cross-Section
N

Figure 3

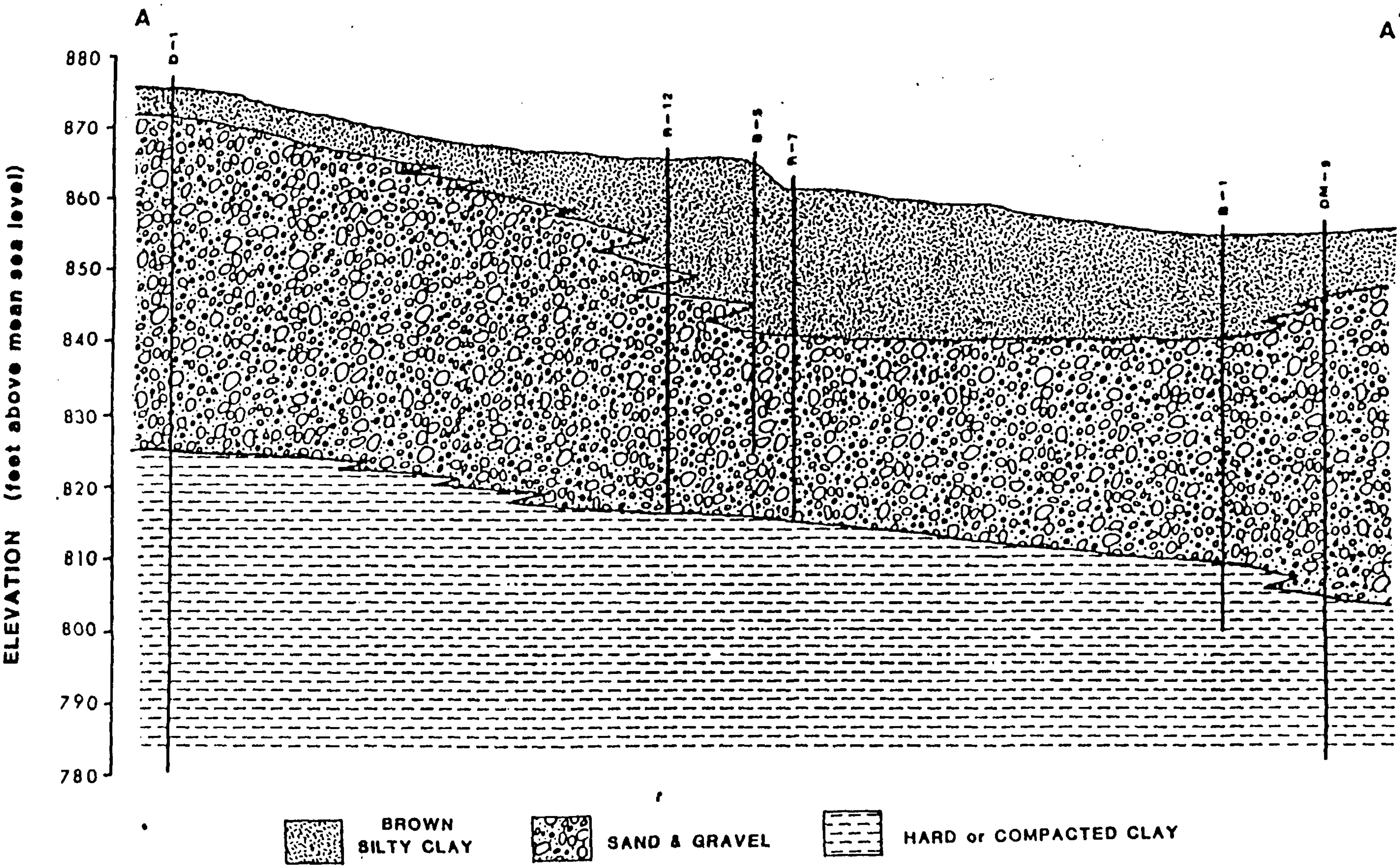


Figure 4
CONCEPTUALIZED GEOLOGIC CROSS SECTIONS FOR PATTERSON-GRANGE HALL ROAD AREA

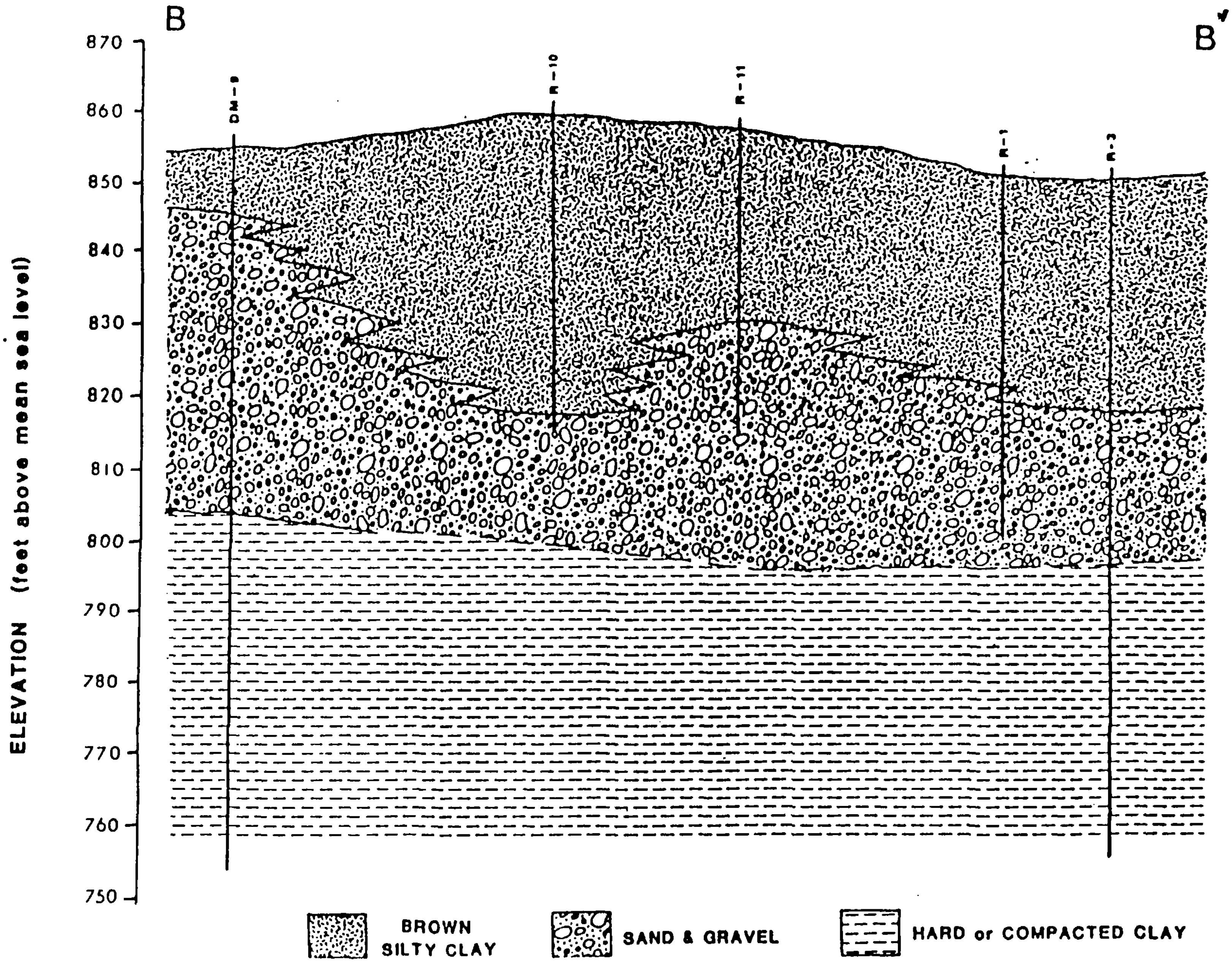


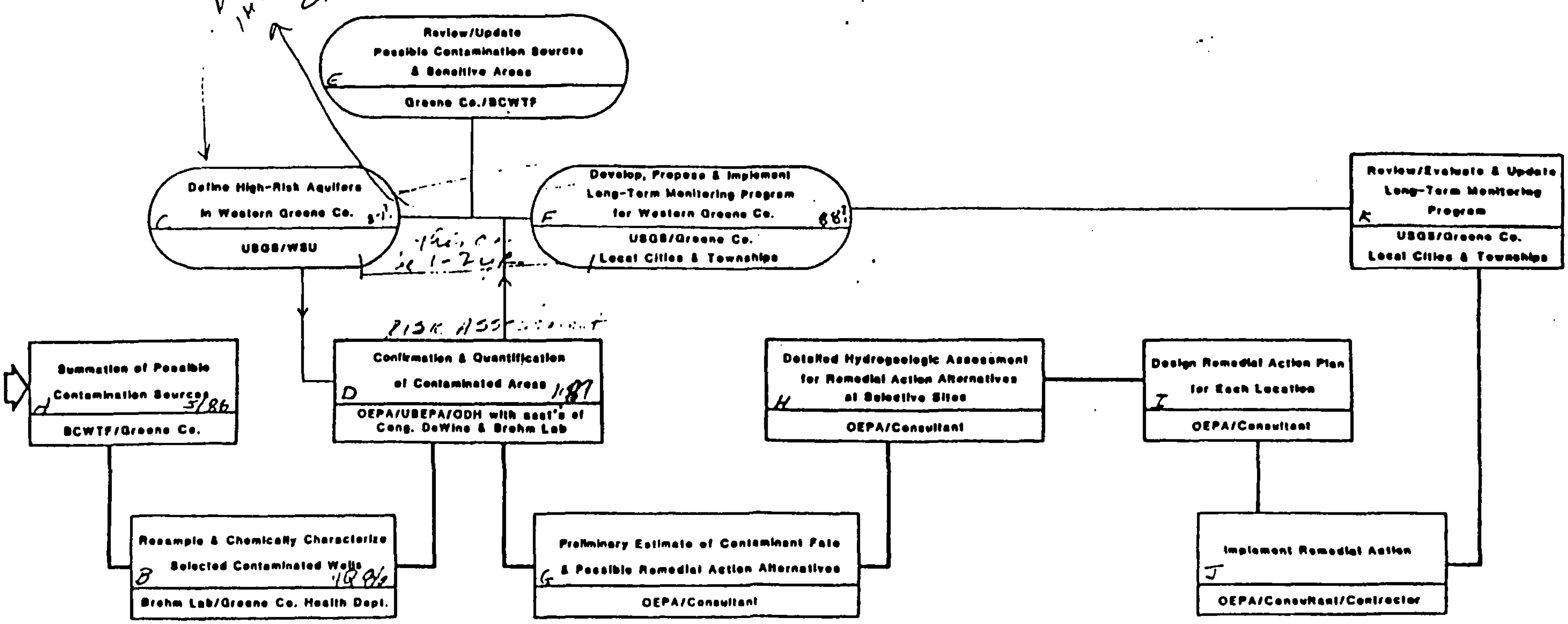
Figure 5
CONCEPTUALIZED GEOLOGIC CROSS SECTIONS FOR PATTERSON-GRANGE HALL ROAD AREA

almost totally lacking in connection with the present problem at this time.

III. CONCEPTUAL WORK PLAN

Figure 6 presents a conceptual work plan for both a short-term evaluation of the ground water contamination problems in the City of Beavercreek and for development of a long-term monitoring program for the high-risk aquifers in western Greene County. The need for accurate assessment of the currently identified potentially-contaminated portions of usable aquifers in Beavercreek Township needs no justification. However, the requirement for a long-term ground water monitoring program covering most of the western half of Greene County may not be as obvious, and this warrants further discussion.

Because of the unique geologic conditions created by glaciers tens of thousands of years ago, western Greene County has beneath its surface an extensive network of ancestral river channels incised deep into the limestone and shale bedrock. These channels or 'buried valleys' were filled, in part, with sands and gravels from the melting glacial ice. Today, these sands and gravels afford some of the highest yielding aquifers in the state. Associated with the ability of an aquifer to produce large amounts of water is the potential of any contaminant introduced into the ground water to travel great distances. Because western Greene County has three major buried valleys, the potential for contaminant movement from one location to another is significant. To insure that the water quality of the buried valley aquifers remains acceptable in areas of water withdrawal



22K

Figure 6

PROPOSED PLAN OF R & D ACTIVITIES TO CHARACTERIZE WATER CONTAMINATION IN THE BEAVERCREEK, OHIO AREA

GANTT Chart to set time lines

and human consumption, a long-term monitoring program is needed to continually assess any adverse impact from known or potential ground water contamination sources.

To understand some of the expected results of each of the eleven tasks listed in the proposed conceptual plan, a task-by-task description is provided in the following, which identifies the work to be accomplished in each phase, and the organizations which are proposed to be involved.

A. Summation of Possible Contamination Sources

The Beavercreek Clean Water Task Force is completing a summary of identifiable industrial sources, both past and present, which may result in ground water contamination. The members of this Task Force are working extensively with the local cities and townships as well as with County agencies. The results of their investigations will serve as the preliminary source identification of possible contamination sources and as the initial template for correlating these possible sources with known contaminated sites. These will permit a preliminary identification of aquifer 'sensitive' areas to be considered as prime candidate a long-term monitoring program.

B. Resampling and Chemical Characterization of Selected Contaminated Wells

As previously discussed, selected wells in which contamination have been found will need to be resampled in order to confirm the presence or absence of the previously reported organic compounds. In addition, wells which are shown to be contaminated with VOCs should also be tested for other possible contaminants. An accepted screening procedure adopted by the USEPA entails analysis of each such sample for a set of "priority pollutants". Priority pollutant analyses are designed to measure some 129 specific organic and inorganic compounds which are listed in this U.S. EPA procedure. Of these 129 compounds, less than thirty comprise the VOC fraction which has been the sole focus of virtually all of the ground water investigations accomplished thus far in Beavercreek. While priority pollutant analyses are considerably more expensive than the more limited VOC analyses, the latter are not adequate for defining contamination sources and distribution.

It is proposed that the Brehm Laboratory resample 9 to 12 of the wells in which significant contaminant concentrations have been reported thus far. Brehm Laboratory scientists will collect the samples and prepare appropriate field spikes, field blanks, and duplicate samples (QA/QC samples) as part of the necessary Quality Control/Quality Assurance procedures. Determination of the inorganics and the standard drinking water parameters which are required as parts of the priority pollutant screening procedures, would be the tasks of the Greene County Health Department. Accomplishing the organic portion of the priority pollutant analyses requires the availability of GC/MS instrumentation and experienced analysts. These determinations would be made by the Brehm Laboratory. Upon completion of these analyses, the results would be reviewed in depth with the Greene County Health Department and with OEPA officials to define any potentially hazardous conditions not previously identified. Also, the results of these analyses will be used to select specific chemical compounds ("markers") which will be used as indicators to characterize the three contaminated areas.

C. Define High-Risk Aquifers in Western Greene County

Concurrent with the resampling and water analyses, as described in Section III B. above, it is proposed that the USGS and Wright State University's Department of Geological Sciences develop and implement a program to define the extent and hydrogeologic characteristics of the buried valley and the 'high-risk' aquifers in western Greene County. The initial portion of this study would require the assembly, standardization, and presentation of all existing information. After deficiencies in this existing data base had been identified, a field exploration program would be required to fill in data gaps.

D. Confirmation & Quantification of Contaminated Areas

With the results obtained from Task III. B. and the initial findings of Task III. C. in hand, the OEPA in coordination with the USEPA and ODH, would then further evaluate the identified areas of significant contamination. The purpose of these investigations would be to delineate as well as quantify the rate and extent of contaminant migration. Drilling, soil sampling and monitoring well installation would all be required in the first portion of these investigations. Both ground water and unsaturated zone soil samples would be subjected to laboratory analyses. If needed, the Brehm Laboratory would be available to assist with organic analyses in this phase (but no costs for this are defined in the present proposal).

The OEPA has stated that a USEPA Field Investigation Team (FIT) is scheduled to come to the Patterson/ Grange Hall Road site for additional investigation in the Spring of 1986. Presumably this group would accomplish some of the studies just mentioned. With the assistance of Congressman DeWine's office, it may be possible to further ensure that such action by a FIT is indeed a commitment of the USEPA. Any work completed during this Task will affect on continued involvement of the federal government during remediation (for example, Superfund activities). Of course, if the services of the U.S. EPA cannot be obtained, all of the tasks described in this section would have to be accomplished by other organizations.

E. Review/Update Possible Contamination Sources and Sensitive Areas

As the high-risk aquifers are defined in more detail, and information from Tasks III. A. through III. D. is obtained, the need for updating the sources of possible contamination, and identifying the locations of greatest environmental sensitivity will arise. Since the area of concern will now be extended to include a major portion of western Greene County, the office of the Greene County Regional Planner, with input from BCWTF, should review and prepare necessary changes for incorporation into the proposed long-term monitoring program.

F. Develop, Propose and Implement Long-Term Monitoring Program for Western Greene County

Once the sources and types of possible ground water contamination and the impact of these on the delineated buried valley aquifers is identified, the USGS should develop, propose and implement a long-term ground water monitoring program at selected locations throughout western Greene County. This program would specifically monitor indicator compounds (defined earlier) which are characteristic of the contamination being introduced. The total number of wells monitored and the duration of the program would be dependent upon the availability of USGS resources, as well as the extent of matching funds available from the County, and from local cities and townships. The information obtained from this program would be used to evaluate the impact of known contamination, assure protection of critical aquifer areas, and determine the change in both ground water supply and quality over a long period of time.

G. Preliminary Estimate of Contaminant Fate and Possible Remedial Action Alternatives

Upon determining the rate and extent of ground water contamination at locations in the City of Beavercreek, the OEPA will be in a position to help develop and evaluate possible remedial action plans. If the extent and nature of the ground water contamination which is defined do not qualify this area for remediation under any State or Federal programs, a consultant should be retained with expertise in the design of ground water remediation programs. With the assistance of the OEPA, this contractor should identify at least three remedial action techniques which could conceptually mediate the contamination problems. Funding for this effort would have to be provided locally if State or Federal support is not feasible.

H. Detailed Hydrogeologic Assessment for Remedial Action Alternatives at Selected Sites

A detailed hydrogeologic assessment of each site which has been confirmed as a source of ground water contamination will be required prior to the selection of a remedial action program. In Task III. G., the retained consultant would have conceptually developed alternatives which could be applied to each site. This subsequent Task would provide the site-specific information needed to narrow the selection of alternatives to the most technologically feasible and the most cost effective programs. The magnitude of this program will be dependent upon the site conditions and the extent of the work which had been completed in Task III. D. The greater the confidence which has been established in the determination of the rate and extent of migration of contamination, the less time and expense will be expended evaluating corrective action.

I. Design Remedial Action Plan for Each Location

During the design phase, the retained consultant would develop cost schedules for all facets of the corrective action at each site. Also, time schedules would be defined to facilitate coordination of all activities so that the corrective action, once the work begins, proceeds as quickly as possible. This is necessary for health and safety purposes, and also to minimize costs which could result from a protracted remediation. The remedial action plan would be reviewed by the OEPA to insure that the proposed program meets all State and Federal requirements.

J. Implement Remedial Action

The program for corrective action developed by the retained consultant and accepted by the OEPA would be assembled as a bid package. Contractors specializing in clean-up programs of hazardous waste sites would be solicited for bids to complete the remedial program. The consultant who developed the remedial action plan should also be retained to oversee the actual work performed by the contractor. This helps to ensure the proper and complete implementation of the program, as designed and accepted by all parties involved.

K. Review/Evaluate and Update Long-Term Monitoring Program

After the remedial action has been completed at each site, a revision of the long-term monitoring program should be made to allow for the incorporation of additional wells for periodically assessing the effectiveness of the corrective action. It is virtually impossible to remove all the contamination from a sand and gravel aquifer such as those which exist beneath western Greene County, once this contamination has been allowed to disperse. However, after the source of the pollutant has been removed, natural degradation and physical dilution within the aquifer usually reduce the contaminant to acceptable levels after a sufficient time period. Through long-term ground water monitoring, the fate and potential impact of this residual contamination can be assessed.

IV. ESTIMATED COST OF INITIAL PHASE OF CONCEPTUAL PLAN

Since the magnitude of the aquifer contamination problem in the Beavercreek area is presently unknown, the cost of most of the several phases of the proposed conceptual plan cannot be estimated at this point. Moreover, in view of the fact that several organizations are proposed to be involved in the R & D investigation outlined herein, it will be necessary for each participating organization to define its own costs in connection with the program. It is possible to estimate with reasonable accuracy the cost of the initial studies which the Brehm Laboratory of Wright State university would undertake. These costs are essentially as follows for the preparation of the plan presented herein (these costs have already been incurred, but the Brehm Laboratory has not been compensated for these expenses as yet), and for Task B. of Section III. of this plan, as described in the foregoing discussion.

A. Estimated Cost of Proposed Brehm Laboratory Studies Only In Initial Phase of Proposed Plan

1. Review of Existing Data and Information and Preparation of Proposed Plan

a. Direct Labor (Includes Fringe Benefits and Indirect Cost):

T.O. Tiernan (16 hrs.)	$1,079.00
B.E. Huntsman (46 hrs.)	$1,504.00
Research Associates (24 hrs.)	$565.00
Total Direct Labor	$3,148.00

b. Supplies and Materials	$35.00
c. Duplication of Plan	$23.00
d. Total Cost of Item A.1.	$3,206.00

2. Additional Field Sampling And Analysis With Associated QA/QC to Verify Contaminated Sites and to Determine a Broader Range of Hazardous Pollutants

a. Field Sampling

1) Direct Labor (Includes Fringe Benefits and Indirect Cost):

B.E. Huntsman (32 hrs.)	$1,046.00
J. Pavlik (32 hrs.)	$619.00
2) Pumping Equipment Rental (Pump and Generator)	$215.00
3) Expendable supplies (filters, sample containers, etc.)	$150.00
4) Total Cost of Item 2a.	$2,030.00

b. Analyses of Field Samples:

1) GC-MS analyses of twelve (12) samples for entire group of priority pollutant compounds at $950.00/sample	$11,400.00
2) Associated QA/QC analyses (spiked samples, etc.); 4 analyses at $950.00/sample	$3,800.00
3) QA/QC Spiking Compound Sets for Field Samples	$350.00
4) Total Cost of Item 2b.	$15,550.00

3. Interpretation of Data From Initial Studies and Preparation of Report

a. Direct Labor (Includes Fringe Benefits and Indirect Cost):

T.O. Tiernan (8 hrs.)	$540.00
B.E. Huntsman (24 hrs.)	$785.00
b. Duplication Costs	$35.00
c. Total Cost of Item 3	$1,360.00

4. Total Estimated Cost for Initial Phase of Brehm Laboratory Studies

$22,146.00

V. CONTINUED PERIODIC MONITORING OF EXISTING RESIDENTIAL WELLS PROVIDING DRINKING TO BEAVERCREEK RESIDENCES

In the initial discussions with Wright State administrators and scientists, City of Beavercreek officials indicated that one reason for involving the University was the possibility of obtaining analyses of water samples from Beavercreek residential wells at a cost which was lower than that being charged by local commercial laboratories. As discussed earlier in this proposal, however, the type of analysis which has been accomplished thus far on these well water samples (only for a small group of Volatile Organic Compounds) is not sufficiently comprehensive to be really useful in defining the source(s) and extent of distribution of the chemical contaminants which are polluting the aquifer in the Beavercreek area. Moreover, the geographical distribution of these residential wells and their varying depths make these inappropriate as monitoring wells for identifying overall pollutant sources and movement. Consequently, as seen from the foregoing discussion in earlier sections of this proposed plan, the residential wells are not factored directly into the comprehensive aquifer characterization and monitoring plan which is recommended for the Beavercreek area.

While the concerns of Beavercreek residents about their respective residential wells are understandable and likely to persist, it is paramount that the sources of water pollutants affecting the entire area be identified and that remedial action be taken to remove these. Otherwise, contamination of residential wells will continue, although it may be sporadic (this is now being demonstrated by the results of more recent water sample analyses in which wells previously found to be "clean" are now shown to be "contaminated", whereas some "contaminated wells", as indicated by previous analyses, now appear to be "clean"). Contrary to popular beliefs (or hopes), sources of such contaminants which are large enough to pollute extensive areas, as appear to be present in Beavercreek, do not suddenly "dry up", and continuing long-term pollution of the aquifer from these can be expected unless these sources are removed.

In view of these facts, if the additional sampling and analyses of a sub-set of the residential wells (with rigid QA/QC and for a more comprehensive set of pollutants, as proposed in Section III.B. of this plan) confirms the presence of hazardous chemicals in significant concentrations, then all residents in the affected area would be well advised to discontinue use of these wells for household purposes or for drinking water sources. However, it is premature to undertake such a program until the more comprehensive priority pollutant analyses proposed in Section III. B. have been completed. The latter may indicate whether or not there are prominent "marker" compounds present among the pollutants, which would be much more appropriate indicators of contamination than the VOC's. If such "markers" can be identified, then additional residential wells could be monitored specifically for these. The scope and cost of such a program would have to be decided at a later date. It must be emphasized again, however, that a residential well monitoring program of this type is not a substitute for the comprehensive program, aimed at identifying pollutant sources and removing these, which is proposed herein.

In summary, the only realistic solution to the problem of chemical contamination of the Beavercreek aquifer is to identify and eliminate the sources and distribution of this contamination through a program such as that outlined herein. This, coupled with a long-term area-wide monitoring program following remedial action, will ensure the continued viability of the aquifer supplying this region.

APPENDIX 7

MAP SHOWING POLLUTION SITES

5.6 The Dayton Oil Company

CERCLA/SARA Classification: Owner

Corporate Status: Incorporated in Ohio, April 10, 1963. Dissolved March 8, 1982.

Registered Agent: James T. Mulligan
118 West First Street
Dayton, Ohio 45402

Basis for Identification: The Dayton Oil Company owned the site property from at least 1945 (the beginning date for ICAIR's title search) until August 14, 1953 when it conveyed the site property to Kohnen and Lammers, Inc. (Warranty Deed, B/02). 1945 – 1953 get more details on operations during this time period

5.7 The Ford Motor Company

CERCLA/SARA Classification: Generator

Corporate Status: Incorporated in Delaware on July 9, 1919.

Mailing Address: The American Road
Dearborn, MI 48121

Telephone: (313) 322-3000

Chief Executive: D. E. Peterson, Chairman

Basis for Identification: According to Mr. Anthony Kohnen, former President of Kohnen and Lammers, Inc., the Ford Motor Company (doing business in Dayton, Ohio) sent chemical wastes to the site facility for reclamation during Lammers' operational years on the site (1953 to 1969).

5.8 General Motors Corporation

CERCLA/SARA Classification: Generator

Corporate Status: Incorporated in Delaware on October 13, 1916.

Mailing Address: GM Building
Detroit, MI 48202

Telephone: (313) 556-5000

Chief Executive: R. B. Smith, Chairman

Basis for Identification: According to Mr. Anthony Kohnen, former president of Kohnen and Lammers, Inc., General Motors Corporation (doing business in Dayton, Ohio) sent chemical wastes to the site facility for reclamation during Lammers' operational years on the site (1953 to 1969).

5.9 Fogerty Manufacturing

CERCLA/SARA Classification: Generator

Corporate Status: No listing with the Ohio Secretary of State.

Mailing Address: No listing in Dayton vicinity.

Telephone: No listing in Dayton vicinity.

Chief Executive: Unknown

Basis for Identification: According to Mr. Anthony Kohnen, former president of Kohnen and Lammers, Inc. , Fogerty Manufacturing (doing business in Dayton, Ohio) sent chemical wastes to the site facility for reclamation during Lammers' operational years on the site (1953 to 1969).

5.10 International Harvester Company (Navistar)

CERCLA/SARA Classification: Generator

Corporate Status: Incorporated in Delaware on March 9, 1987.

Mailing Address: 401 N. Michigan Avenue
Chicago, IL 60611

Telephone: (312) 836-2000

Basis for Identification: According to Mr. Anthony Kohnen, former President of Kohnen and Lammers, Inc., International Harvester Company (doing business in Springfield, Ohio) sent chemical wastes to the site facility for reclamation during Lammers' operational years on the site (1953 to 1969).

5.11 Monsanto Company

CERCLA/SARA Classification: Generator

Corporate Status: Incorporated in Delaware on April 19, 1933.

Mailing Address: 800 N. Lindbergh Boulevard
St. Louis, MO 63167

Telephone: (314) 694-1000

Basis for Identification: According to Mr. Anthony Kohnen, former President of Kohnen and Lammers, Inc., Monsanto Company (doing business in Addison, Ohio) sent chemical wastes to the site facility for reclamation during Lammers' operational years on the site (1953 to 1969).

5.12 The Moran Paint Company

CERCLA/SARA Classification: Generator

Corporate Status: Delaware Corporation registered to do business in Ohio on February 11, 1980.

Mailing Address: West Ankeney Mill Road
Beavercreek, OH

Telephone: (513) 426-2641

Basis for Identification: According to Mr. Anthony Kohnen, former President of Kohnen and Lammers, Inc. during its operational years on the site (1953 to 1969), The Moran Paint Company (doing business in Xenia, Ohio) sent chemical wastes to the site facility. This information was also collaborated by Mr. James Lukan, Director of Environmental Health Division, GCHD (Lukan Interview).

5.13 Stolle Corporation

CERCLA/SARA Classification:	Generator
Corporate Status:	No listing with the Ohio Secretary of State
Mailing Address:	1501 Michigan Street Sidney, Ohio 45365
Telephone:	(513) 492-1111
Chief Executive:	Mr. Richard Pope

Basis for Identification: According to Mr. Anthony Kohnen, former President of Kohnen and Lammers, Inc., the Stolle Corporation (doing business in Sidney, Ohio) sent chemical wastes to the site facility for reclamation during Lammers' operational years on the site (1953 to 1969).

5.14 Inland Company

CERCLA/SARA Classification:	Generator
Corporate Status:	No listing with the Ohio Secretary of State.
Mailing Address:	No listing in Dayton vicinity.
Telephone:	No listing in Dayton vicinity.
Chief Executive:	Unknown

Basis for Identification: According to Mr. Anthony Kohnen, former President of Kohnen and Lammers, Inc., Inland Manufacturing Company (doing business in Dayton, Ohio) sent chemical wastes to the site facility for reclamation during Lammers' operational years on the site (1953 to 1969).

5.15 Specialty Papers

CERCLA/SARA Classification: Generator

Corporate Status: No listing with the Ohio Secretary of State.

Mailing Address: No listing in Dayton vicinity.

Telephone: No listing in Dayton vicinity.

Chief Executive: Unknown

Basis for Identification: According to Mr. Anthony Kohnen, former President of Kohnen and Lammers, Inc., Specialty Papers (doing business in Dayton, Ohio) sent chemical wastes to the site facility for reclamation during Lammers' operational years on the site (1953 to 1969).

5.16 Angell Manufacturing Company

CERCLA/SARA Classification: Generator

Corporate Status: Incorporated in Ohio on April 11, 1979.

Mailing Address: 1516 Stanley Avenue
Beavercreek. OH 45404

Telephone: (513) 461-5800

Chief Executive: Richard Anglin, President

Basis for Identification: According to Mr. Anthony Kohnen, former President of Kohnen and Lammers, Inc. during its operational years on the site (1953 to 1969), The Angell Manufacturing Company, a nameplate manufacturer, sent flammable solvents, mainly acetone, to the site facility. According to Mr. Greg Buthkar, Environmental Engineer and Project Coordinator, OEPA, the Angell Manufacturing Company also sent trichloroethylene to the site facility.

7. Interviewee: Anthony Kohnen
Former President of Kohnen and Lammers, Inc.
(Lammers, Inc.)
c/o Multi-Tech Medical Services
P.O. Box 5
Dayton, OH 45449
(513) 866-9992

Mr. Kohnen was contacted by ICAIR in October, 1987 in connection with ICAIR's investigation of the Valleywood Subdivision site to determine the use, manufacture and/or storage of chlorinated solvents and/or vinyl chloride at the former chemical reclamation plant site of Lammers, Inc. and to gather information concerning all aspects of operations at the plant including the identity of parties generating the chemicals sent to the plant during its operational years.

Mr. Kohnen stated that the company (Lammers, Inc.) began operations at the plant site in 1953 and ceased operations in 1969 when the plant was destroyed by fire. The company engaged in the distillation and fractionalization of waste industrial solvents. This process utilized one potstill, two thin film evaporators and two fractionalization columns. The chemical wastes to be reclaimed were almost always picked up by Lammers, Inc.; rarely did a generator transport the chemicals to the plant. The plant received 4,000 to 5,000 gallons of chemicals per day. These chemicals included chlorinated solvents, but, according to Mr. Kohnen, no vinyl chloride or related products were ever received at the plant.

Mr. Kohnen stated that the plant would receive the solvents from the generators, purify the solvents, and then return the clean solvents to the generators. From 1953 to 1967 the plant also cleaned out the drums or barrels for these generators and then returned them to the companies. Some barrels were also received (for cleaning and return) from oil companies during this time period. The chemicals were stored in 4,000 and 10,000 to 12,000 gallon ground-diked tanks on the property. Waste solvents kept after reclamation were picked up by a company in Dayton (Mr. Kohnen does not recall the name of this company) which then transported it to a landfill. Mr. Kohnen stated that no spills occurred on the plant property and the plant observed "good house-keeping" practices in dealing with the solvents.

Mr. Kohnen stated that all company records were destroyed in the 1969 fire at the plant. He recalls, though, that most of the plant's customers were connected with the automotive business. Out of the 50 to 100 customers of the plant, Mr. Kohnen remembers only the biggest customers which were: The Ford Motor Company (Dayton, OH), General Motors (Dayton, OH), Fogerty Manufacturing (Dayton, OH), International Harvester (Springfield, OH), Monsanto (Addison, OH), The Moran Paint Company (Xenia, OH), Stolle Corporation (Sidney, OH), Inland Manufacturing (Dayton, OH) and Specialty Papers (Dayton, OH). He does not recall what types of solvents the plant received from these companies. Upon inquiry by ICAIR, he confirmed that Angell Manufacturing Company, a nameplate manufacturer, sent flammable solvents, mainly acetone, to the plant. He believes the Angell Manufacturing Company is no longer in business.

Mr. Kohnen stated that, during plant operational years, the company had no problems with citizens or government agencies and that there were no permit or reporting requirements. The Beavercreek Fire Department would semi-annually inspect the plant site regarding safety procedures and site accessibility in case of fire. According to Mr. Kohnen, the company always observed safety procedures and the Fire Department never found any problems concerning the company's methods of handling solvents.

Mr. Kohnen was not recontacted by ICAIR in April, 1988 for this report in accordance with directions received from the EPA Region V Primary Contact, Ms. Ruth Mancos.